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CONTENTS

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Orthodontics

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VOL. 31 NOVEMBER, 1945 NO. 11

Original Articles

DIAGNOSTIC AND TREATMENT RECORDS

WILL G. SHEFFER, D.D.S., SAN JOSE, CALIF.

IN THESE busy times when orthodontists are cracking up right and left and patients are waiting years for treatment, the question arises, "Is it necessary to keep complete records?"

Occasionally a transfer patient does bring with him adequate records that are most helpful in the continuance of treatment. But, all too frequently patients report for continuance of treatment with only part of the appliances in place, with no records at all, or with tales of the records having been lost by the original orthodontist. Usually these patients, who are truly orthodontic war-casualty patients, remain just long enough in one place to have the appliances only partially reconstructed, and then move to another military camp center taking enough time before reporting to the next orthodontist to wiggle off some more of the bands.

In starting treatment we dislike lowering our standard of office procedure, so continue making records and collecting data, eliminating only those procedures that appear nonessential. Apparently there is no limit to the collecting of data, all of which might prove helpful in treatment or in the understanding of the case when reviewed later.

Today, orthodontics requires a knowledge of so many branches of medicine and allied sciences that it is little wonder that the orthodontist's personal inabilities prove to be limitations in his compilation of adequate data that would permit him to understand better the patient's physical condition before he cements bands on teeth. An orthodontist might discontinue making photographs because he dislikes photography. Or he might discontinue charting his photographs because to explain those chartings to the patient's parents requires those few extra minutes that make a crowded schedule more difficult.

There is much diagnostic data collected in every orthodontic office that will never be used. But it is there to be used if and when the orthodontist finds the time, the necessity, or the desire to tabulate it. How seldom we make a differential diagnosis even though the data is at hand awaiting tabulation. But

Read before the Southern Section, Pacific Coast Society of Orthodontists, Los Angeles, May 24, 1945.

what a joy it is to refer a patient to a fellow orthodontist in another city if adequate records have been made before treatment was started!

There is a standard of records set by the type or quality of orthodontics practiced in a community which indirectly determines how much time is spent obtaining records before actual treatment is started. This standard spurs the individual orthodontist on to make not only beginning records but also progress and completion-of-treatment records. The presentation of before-and-after reports of treatment at meetings and for publication in journals keeps our morale high in making use of the data obtained. For many years the American Board of Orthodontics has advocated that a routine procedure with adequate record data be followed in the presentation of case reports.

Inadequate or antiquated office equipment can greatly limit the orthodontist's record-making endeavors. In normal times, an orthodontist would not think of driving an automobile that was ten years old, yet his office and his office equipment are seldom revamped or renewed. It is the orthodontist's privilege to limit his record-making activities to a minimum if he so desires. I know of one orthodontist who had two impression trays—an upper and a lower. He made no photographs or charts or x-ray pictures. He did not finish his models, yet he obtained beautiful orthodontic results and was highly respected in his community.

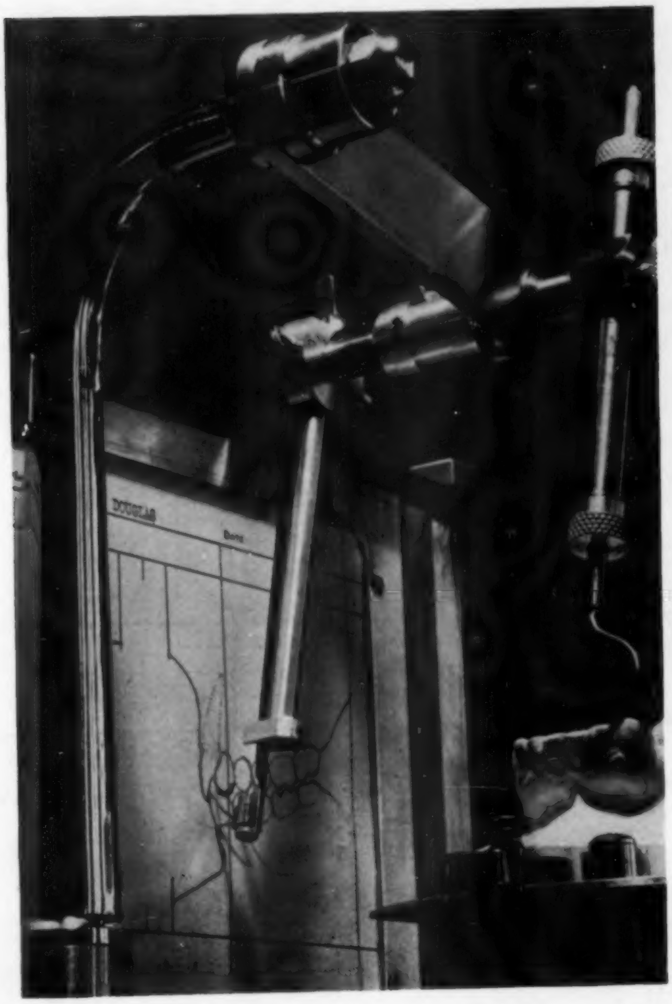
A. *B.* *C.*

Fig. 1.—*A*, Before treatment. *B*, One year after active treatment. *C*, One year after discontinuance of retainers.

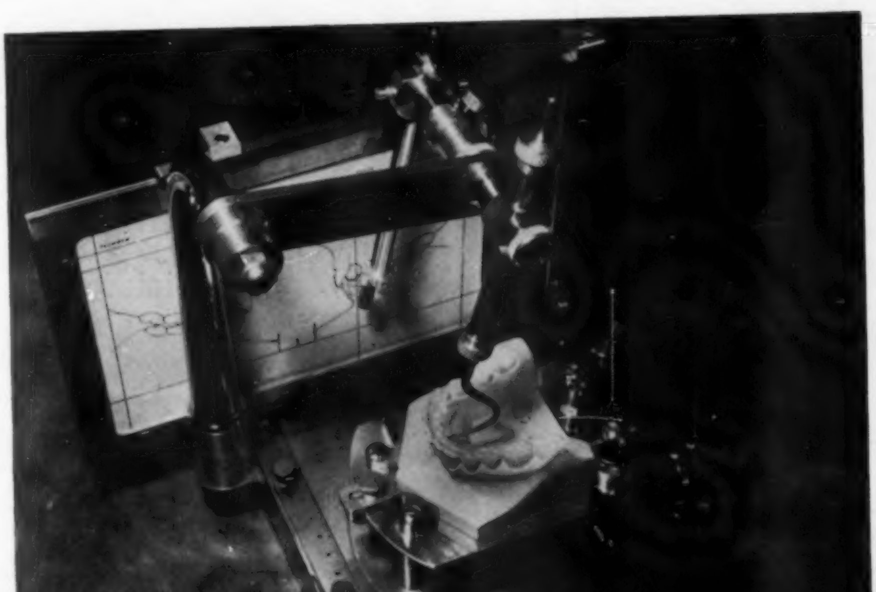
About twenty-three years ago, Dr. B. E. Lischer introduced gnathostatics to the orthodontists of the Pacific Coast region. The study of this method of investigation developed in the orthodontists an ability to view deviations of the denture in relation to three cephalometric planes of the head rather than the relation of the teeth to each other.

Many orthodontists throughout the country, inspired by the accuracy of their gnathostatic records, presented interesting clinics. For the next several years our orthodontic journals published many papers on gnathostatics and case reports, showing models, charts, and photographs. At first, these papers were explanations of the technique of the method of investigation. Later, before-and-after treatment records and differential diagnosis reports showed that orthodontists were becoming more scientific in their diagnostic procedures.

A few years later, however, many orthodontists found that charting the photographs and making gnathostatic charts and differential diagnosis charts



A.



B.

Fig. 2.—Charting: *A*, Labial. *B*, Lingual.

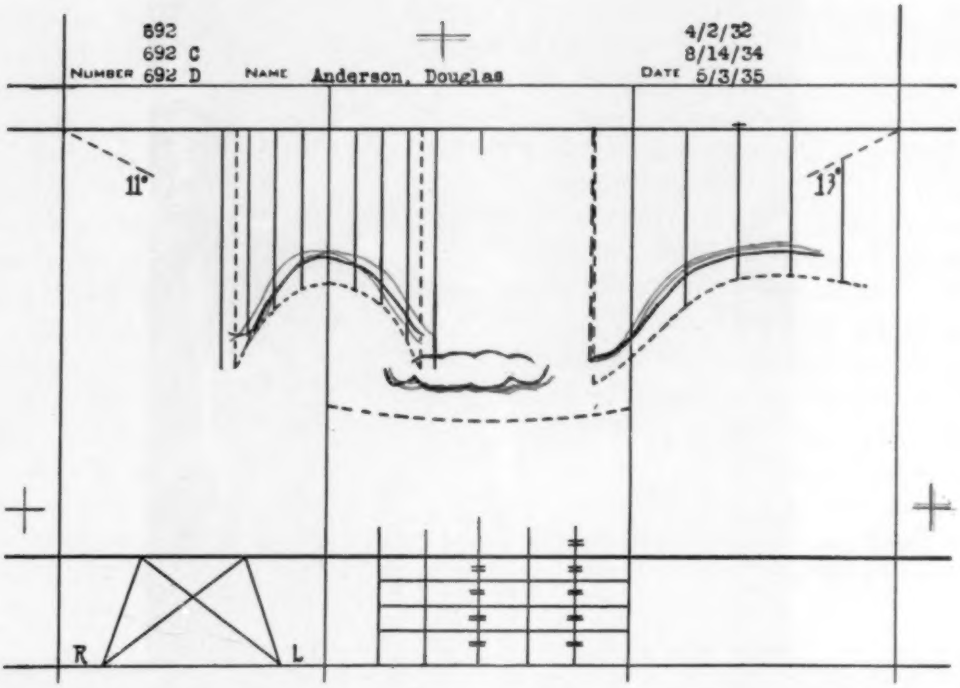


Fig. 3.—Chart of transverse palatal, incisal, and median sagittal palatal curve tracings of Fig. 1.

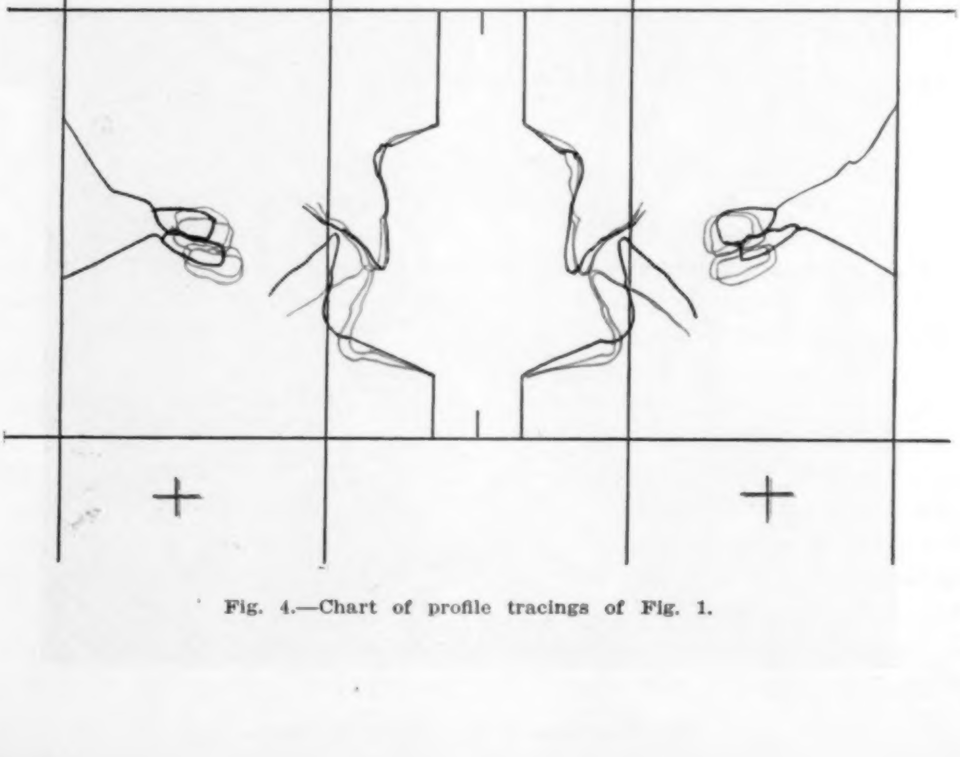


Fig. 4.—Chart of profile tracings of Fig. 1.

consumed more time than could be given to obtaining records. With the advent of smaller, more resilient chrome-alloy arch wires, more teeth were banded. The extra time and effort spent in this way on treatment procedures gradually took precedence over the collecting of diagnostic and record data. Not all orthodontists are careful enough in their charting and gnathostatic technique to produce results accurate enough to be worth the effort expended. The more inaccurately the records are made, the less of value they become and the sooner such record-collecting procedures are discontinued. Those who discontinued record making for this reason were the first to take up the cry of criticism of gnathostatics when others magnified the fact that the eye-ear plane lay within the growing part of the face, and that therefore the orbital plane could not be constant. One orthodontist, in anticipation of proving that the gnathostatic-impression technique itself could not be accurate, made impressions every week of several patients. It was found after a few months that the greatest discrepancy was when at one time an orbital marker was misplaced 2 millimeters.

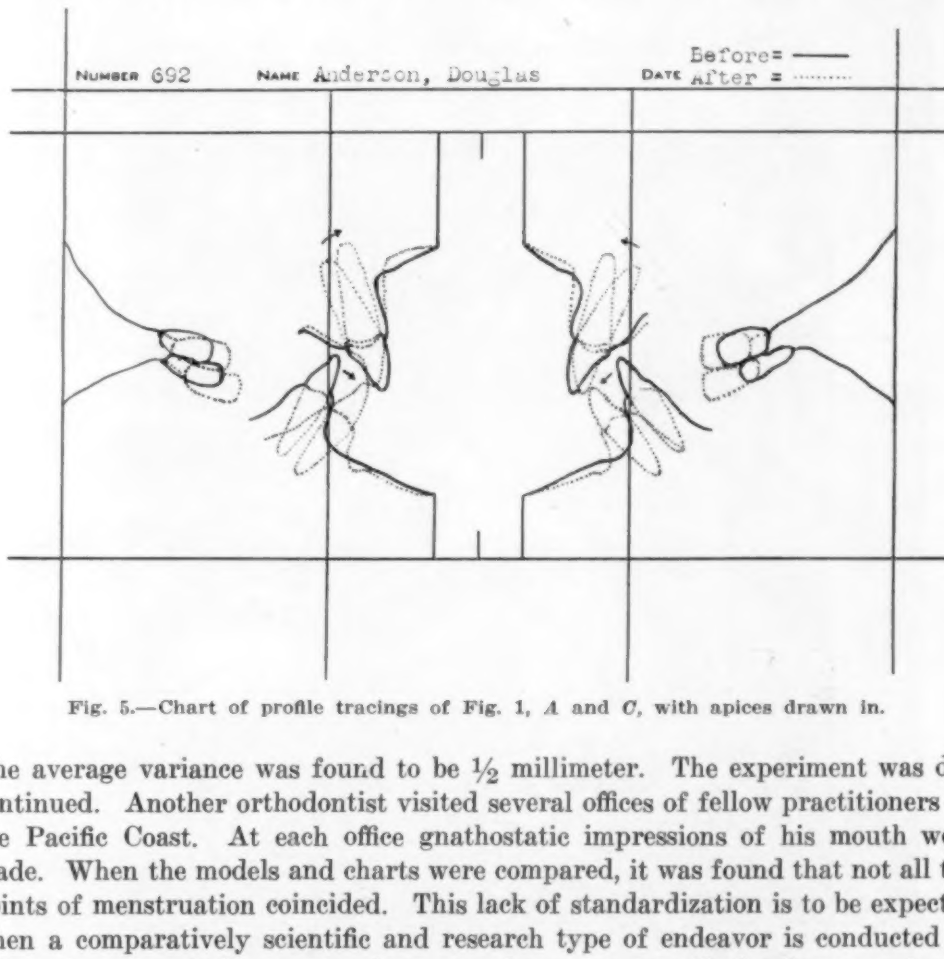
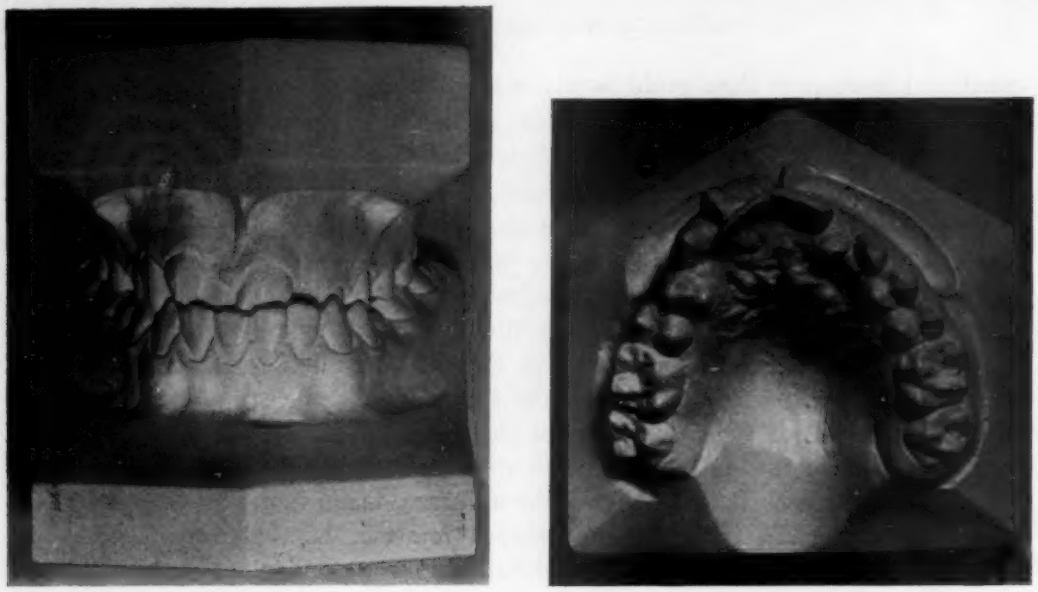


Fig. 5.—Chart of profile tracings of Fig. 1, *A* and *C*, with apices drawn in.

The average variance was found to be ½ millimeter. The experiment was discontinued. Another orthodontist visited several offices of fellow practitioners on the Pacific Coast. At each office gnathostatic impressions of his mouth were made. When the models and charts were compared, it was found that not all the points of menstruation coincided. This lack of standardization is to be expected when a comparatively scientific and research type of endeavor is conducted in different parts of the country by men who are not meticulously accurate research workers. Objections to the clumsy appearance of the gnathostatic models have been overcome by some orthodontists by trimming the upper cast to a plane parallel to the eye-ear plane. And in the other extreme, one orthodontist built up the height of the upper cast of his ordinary models so that his model-display cabinet would appear to be filled with gnathostatic models.

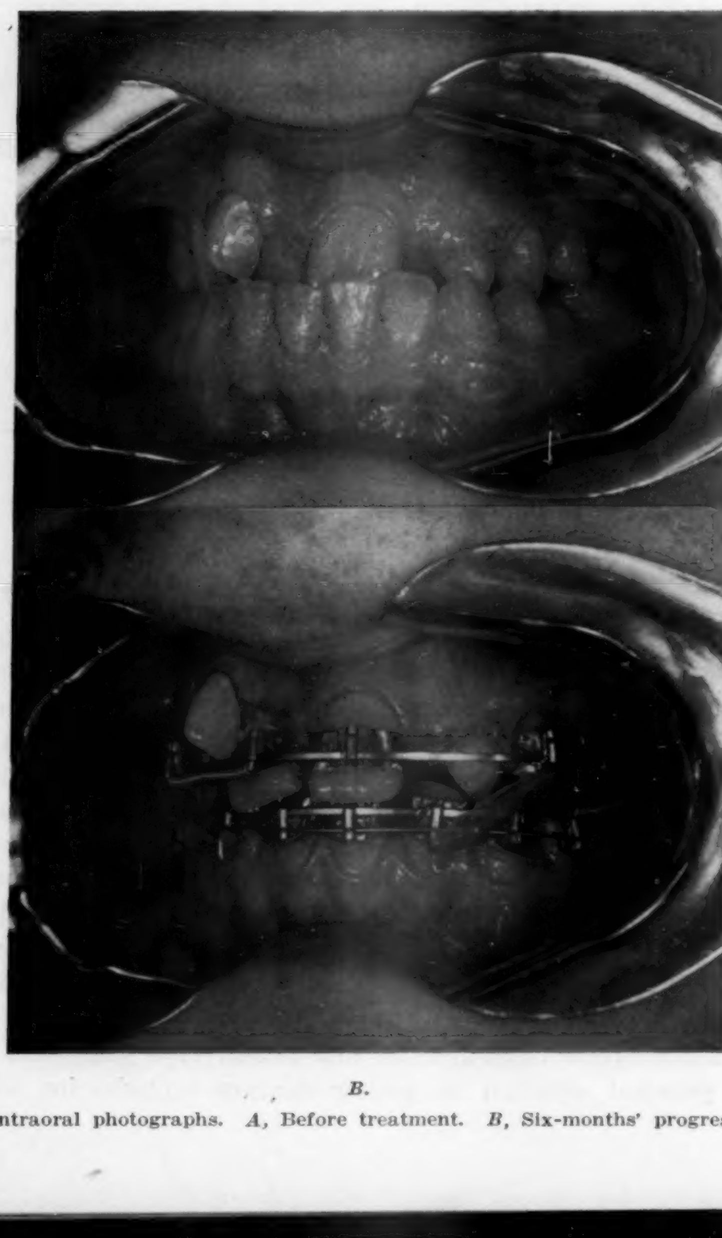
When, about twelve years ago, the new former type gnathostat was introduced, the personal equation in plaster denture reproduction making was



A. *B.*

Fig. 6.—Showing maxillary retraction. ***A*, Front; *B*, Occlusal.**

A.

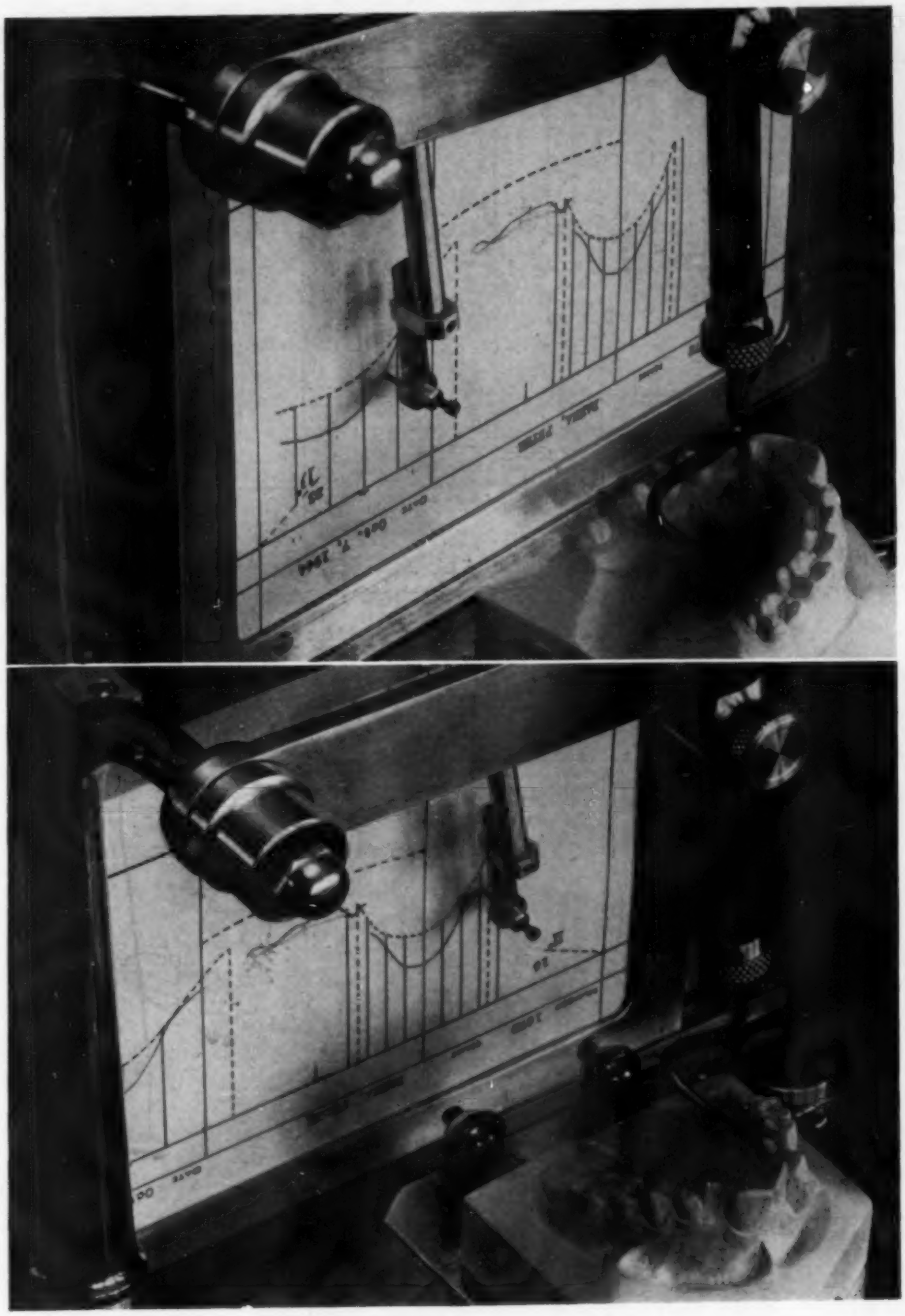


B.

Fig. 7.—Intraoral photographs. ***A*, Before treatment. *B*, Six-months' progress record.**

further eliminated. More uniformity was accomplished without subsequent trimming. With the casts built out to standard size it became easier to determine more accurately the amount of movement of the teeth obtained during treatment. Gnathostatic plaster denture reproductions are made by many orthodontists, but few complete the investigation by making charts.

A.



B.

Fig. 8.—Tracing *A*, median sagittal palatal plane; *B*, transverse palatal plane.

About ten years ago the introduction of the work of Dr. B. Holly Broadbent to the orthodontists of the Pacific Coast region brought the realization that at last a point in the head had been found from which tooth movement and growth

of the denture could be measured. The vast amount of research that has been conducted at Western Reserve University establishing definite growth patterns of the human denture is truly a valuable contribution to orthodontics. At once the orthodontists of the country recognized that records, to be of any scientific

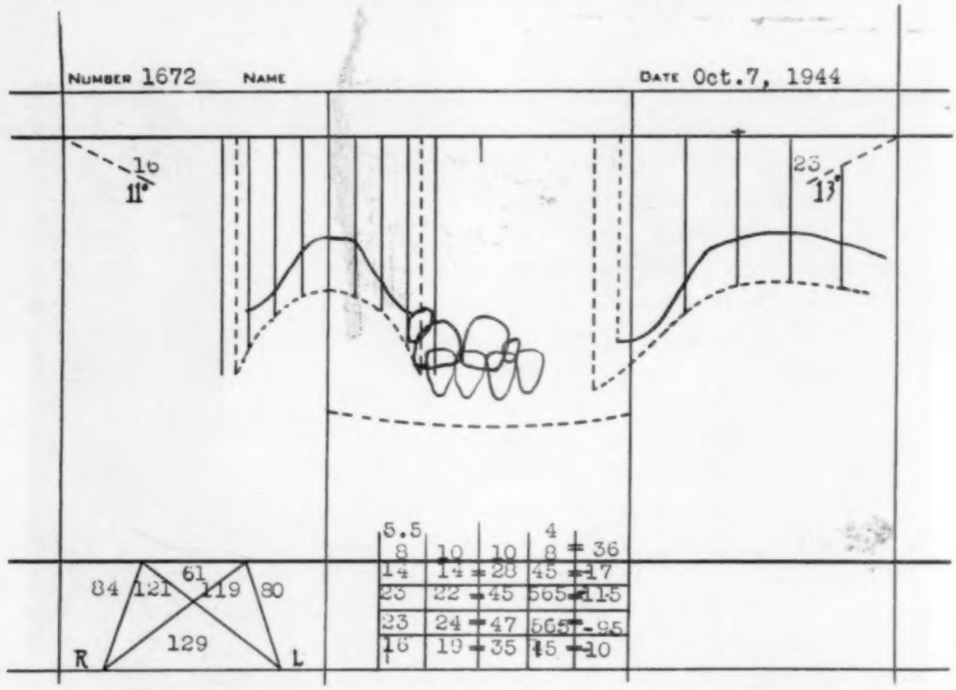


Fig. 9.—Chart showing graph tracings of Fig. 8. Also tracing of incisal crowns.

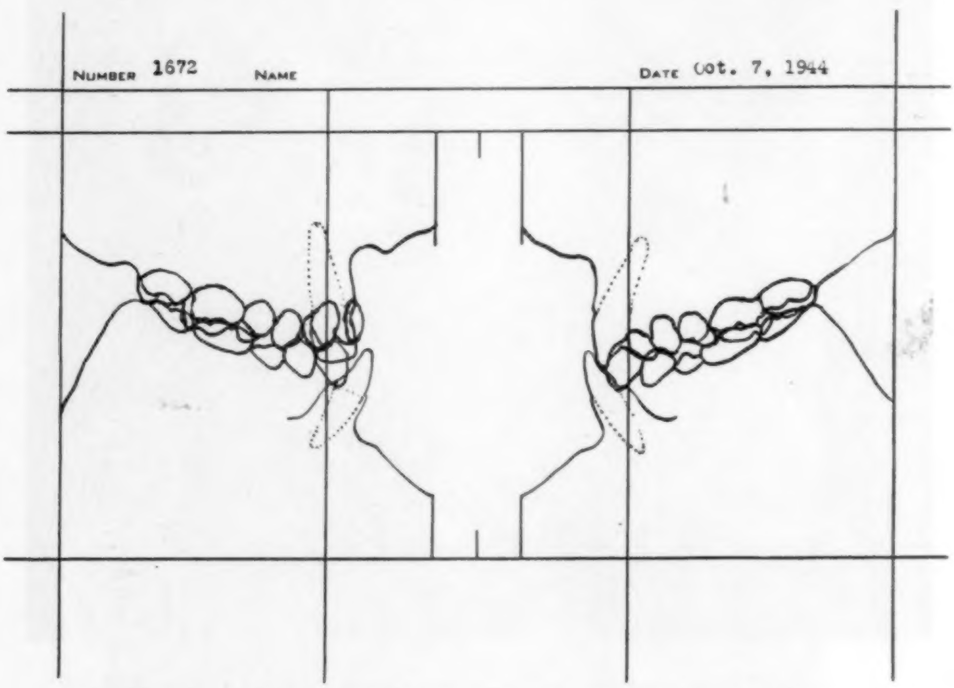


Fig. 10.—Chart of profile tracings of Fig. 6 with incisal apices drawn in.

value at all, should be made by careful research workers with an equipment and a technique that did not vary throughout the years, and that the utilization of the points of mensuration be constant. Our journals now frequently show

tracings from cephalometric x-ray pictures. The denture patterns of these tracings tell graphically of the amount of movement of the teeth accomplished during treatment.

Many orthodontists and a few educational institutions are now making these graphic tracings of cephalometric x-ray pictures. It has been found that the eye-ear plane descends as the patient becomes older. This descent between the ages of 1 month and 9 years progresses more in the posterior area than it does in the anterior area. Between the ages of 9 and 18 years, there is but a slight downward change with the anterior portion of the eye-ear plane progressing slightly more than the posterior. There is a forward growth of the orbitale which causes the orbital plane to pass through the lower denture area about 2 mm. progressively forward in the years between 9 and 18—the orthodontic treatment age. Those using gnathostatics as a method of investigation or to record movement of the teeth must realize that this variance exists. It causes the teeth to chart up about 1 mm. distal during average treatment time. Forward movement of the teeth is therefore about 1 mm. more than gnathostatic chartings indicate.

Measurements of growth obtained with cephalometric x-ray tracings are more desirable than those made with the gnathostat because the base from which the tracings are made is closer to the growing center of the head. Nevertheless, in the hands of many orthodontists the gnathostatic investigation still offers the simplest way of obtaining far more records than will ever be used in the average office procedure. In every orthodontic office where gnathostatic plaster denture reproductions have been carefully made there is a vast store of information about the movement of teeth that can be recorded in pattern form tracings. The amount of inaccuracy due to individual variances is so slight that it may be termed negligible.

The illustrations accompanying this paper show one way that much heretofore unrecorded valuable information about the movement of teeth can be brought into useful, graphic form.

THE APPLIANCE OF MY CHOICE AND THE REASONS WHY I EMPLOY IT*

JAMES DAVID McCOY, D.D.S., LOS ANGELES, CALIF.

IN THIS day and age of diverse and frequently conflicting opinions it is well to subject our own ideas to careful analysis. As long as appliances are essential in the correction of dentofacial anomalies, their manner of action and direct and indirect effects should be known, or else they may become agencies of trauma and damage. Perhaps we are justified in becoming academic, at least briefly in discussing this subject, by proffering a definition: "An orthodontic appliance is a mechanism for the application of pressure or traction to teeth individually, in groups, to the dental arches singly, or in their opposed state, with the object in view of bringing about the changes in these structures necessary to establish normal anatomical and functional balance."

Such mechanisms are classified according to their manner of use, those employed upon the buccal or labial portions of the teeth being known as "labial arch wires," while those utilized upon the lingual aspects are termed "lingual arch wires." Other control features consist of "anchor bands" upon the molar teeth and "attachment bands" upon individual teeth. The manner of securing union between the arch wire and individual teeth to be moved frequently gives us the official name by which the mechanism is designated. The majority of such attachments have been patented and exploited, so thus we have "the ribbon arch attachment," "the edgewise arch attachments," "the twin arch attachment," and perhaps others. The "open tube attachment" which will form the basis of this discussion has never been covered by patents, can be manufactured without restrictions by anyone, and has never been exploited. Like the others, it gets its name from the manner in which the labial arch wire is joined to the teeth to be moved or controlled. In this way and through such channels of thought, the title "open tube appliance" has evolved.

The attachment or "open tube" is made, preferably, or a resilient precious metal alloy, is self-locking and therefore does not require the use of ligatures, lockpins, or other independent means of being locked in. It provides a controlled nonrigid attachment and therefore subjects teeth to the minimum of restraint and trauma. For this reason there is very little or no pain response when it is properly applied. Through the soldering of certain simple auxiliaries to the arch wire, additional sources of control are gained, so that bodily, or tipping movements, as well as rotations, are easily accomplished. Figs. 1 and 2 show a few applications of such agencies.

This means of controlling tooth movement was introduced many years ago by Dr. Calvin S. Case, and the indications for its application according to his interpretations were fully described in his book.† That its possibilities were not fully appreciated by any number of practitioners is apparent. This was due in

*Part of a Symposium presented before the Southern Section of the Pacific Coast Society of Orthodontists on May 25, 1945, at Los Angeles. Other speakers included Dr. Spencer Atkinson, "The Universal Appliance"; Dr. J. A. Linn, "The Ribbon Arch"; Dr. Hays Nance, "The Edgewise Arch." If and when their contributions are ready for publication they will appear in sequence.

†Case, Calvin S.: Dental Orthopedia and Prosthetic Correction of Cleft Palate, 1921, C. S. Case Co.

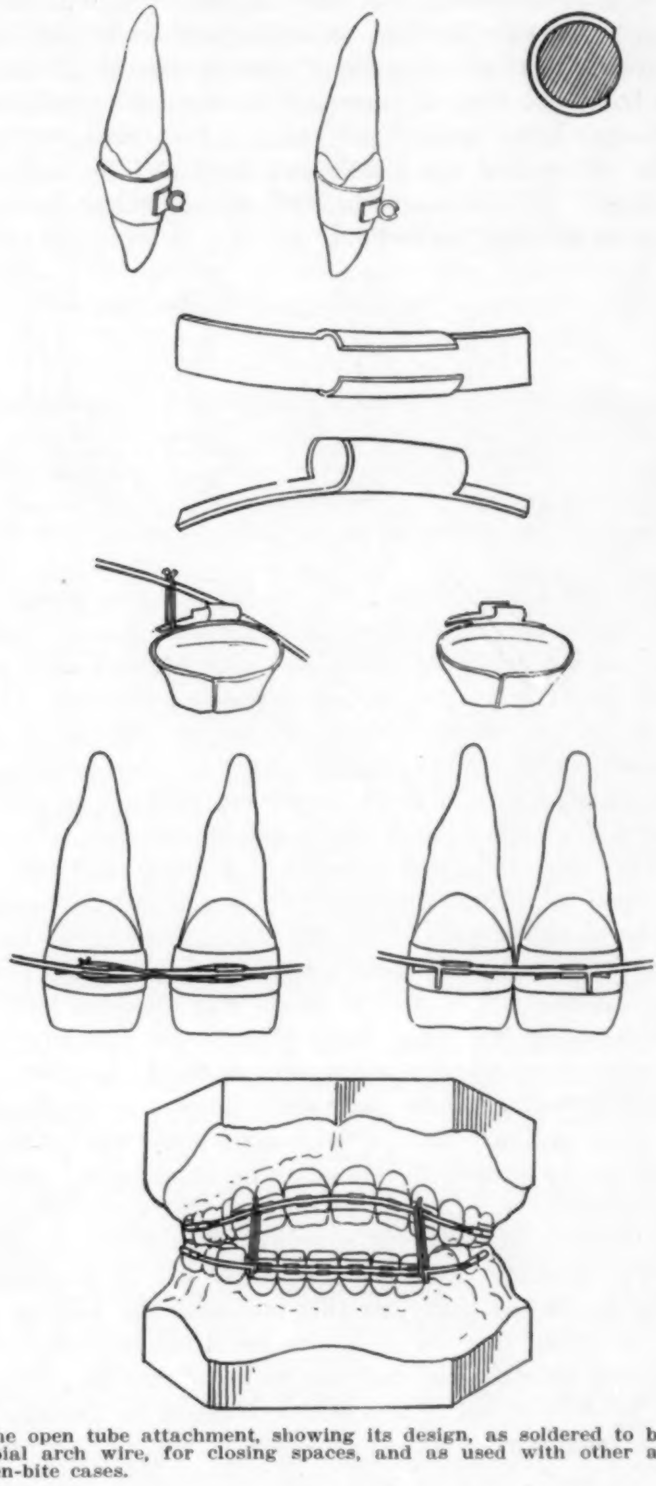


Fig. 1.—The open tube attachment, showing its design, as soldered to bands for the reception of a labial arch wire, for closing spaces, and as used with other appliances in the treatment of open-bite cases.

part to the fact that suitable alloys for its construction were not available, and, owing to the exacting character of this factor, the other details essential to its perfection could not be worked out until this had been solved. Any such metal or alloy must have sufficient strength and resiliency to allow for the opening and closing of the tube incident to locking and unlocking the arch wire. When, for instance, nickel-silver, gold of various grades, platinum or iridio-platinum were tried out, they all possessed characteristics unfavorable to this operation, and, after being opened and closed a few times, would break, thus necessitating the removal of the attachment band and the soldering on of a new "open tubing." This nuisance in itself was sufficient to discourage any busy operator from utilizing the method.

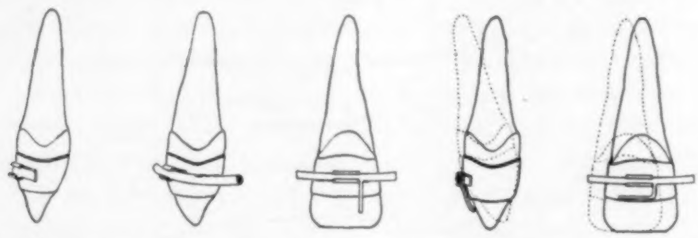


Fig. 2.—Various means of force control gained by soldered additions to the labial arch wire.

First used by the writer in 1907, this medium of attachment was soon discarded for the reasons mentioned above. With the introduction of gold platinum-palladium alloys, it was tried out again, and after a series of experiments several alloys quite favorably adapted to the purpose were found. These, however, did not come up to the standard required, so the cooperation of an expert metallurgist* was secured, and through his help an alloy consisting of gold 60 per cent, platinum 20 per cent, silver 10 per cent, copper 10 per cent was developed. After a thorough trial, it was demonstrated that this constituted an ideal alloy. After further experiments, it was found that the most suitable thickness for "open tube" was 0.010, and the best width for universal use was 0.091 inch. Therefore, strips of material were obtained in this width and thickness in foot lengths for easy handling. In endeavoring to work out a plan for making the attachments, a pair of pliers was designed having a die and counter die for swaging the tubes, but owing to the difficulty in having the dies made for other practitioners to use, this method was given up as it was found that "open tubes" could be quite easily formed by bending the material about the end of an ordinary pair of flat-beaked pliers the beaks of which had been filed down to the proper thickness, or by bending the material about a round wire of suitable size. In spite of the fact that a suitable alloy had been developed, considerable difficulty was encountered in always securing the metal strips in uniform thickness, and this frequently led to annoyance, especially when the material was too heavy, as this increased the holding power of the attachment to the extent that the arch wire could not be unlocked readily. In fact, sometimes the resistance offered was so great that in prying it loose the surface of the band to which it was soldered would be disturbed. It will be recalled that the arch wire is locked into each attachment by placing the first finger behind the tooth involved and exerting pressure with the thumb. It should "snap" into place. To unlock it, an ordinary dental chisel having a long sharp bevel is inserted beneath the arch wire directly adjacent to the attachment, and with a slight prying motion it is "snapped out." When necessary to render

*Mearle W. Wilkinson, E.M., M.S., Santa Monica, California.

attachments more "snug," pressure from a pair of smooth-beaked pliers will accomplish this purpose.

In an effort toward overcoming some of the difficulties mentioned, the attachment shown in Fig. 1 was designed. These new and improved appliances were machine-made from accurate dies, which insured uniformity, and are stamped from a cross-shaped piece of material so that two arms extend laterally from the open tube. These arms serve to reinforce the labial surface of the band to which the attachment is soldered and prevent it from becoming loosened during the process of locking and unlocking the arch wire. They are not of equal length, one being longer than the other, so that if a tooth is to be rotated, the end of the longer arm may be left unsoldered from the surface of the band and a delicate hook formed for the attachment of a ligature (see Fig. 1). Silk or some other form of contractile material will be found very useful for this purpose.*

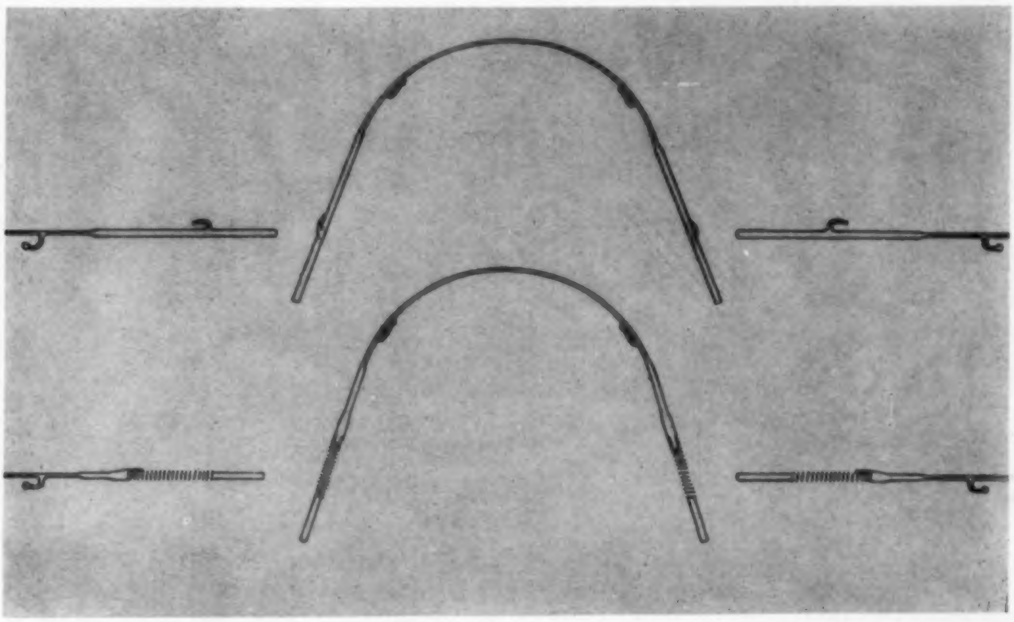


Fig. 3.—Two types of labial arch wires, either one of which may be used to complete the maxillary appliance. They should be made of resilient precious metal alloy, with the central or working portions 0.030 inch in diameter and with the end sections which engage the anchor bands of heavier material, which is usually 0.038 inch in diameter. In one instance, ordinary "stops" are employed, while in the other, coil springs, protected by an attachment made by soldering an open tube to the arch wire, is used. The attachment covers one end of the spring and holds it securely in place.

The labial arch wire to complete the maxillary appliance is of special design. It should be made of a resilient precious metal alloy, with its working portion 0.030 inch in diameter, and with the end sections engaging the anchor bands of heavier material, usually 0.038 inch in diameter. This mechanism is shown in Fig. 3 where two types of the same appliance are illustrated. In one instance ordinary "stops" are employed, while in the other, coil springs protected by a special attachment serve the purpose of length control as well as force control. The heavier end sections provide greater stability, not only for control of the molars which must be frequently rotated, but also in bringing about changes in the frontal segment of the dental arch such as depressing or elevating the incisors. They also provide safety against bending or other distortion under the impact of food during mastication. Through the addition of

*These findings were presented in a paper read before the eleventh annual meeting of the Pacific Coast Society of Orthodontists at San Francisco, Feb. 18, 1924.

coil springs, supplemented by secure anchorage in the frontal segment and intermaxillary traction transmitted through rubber bands, the molars may be moved posteriorly and into positions of advantage with their lower antagonists when such changes are to be desired.

In conjunction with this, a removable lingual arch wire is used upon the mandibular teeth and this also differs from that ordinarily used in that it is stabilized by banding one or more of the anterior teeth. It is constructed of precious metal alloy, the base wire being 0.038 inch in diameter. The usual auxiliary springs of small diameter are employed, when necessary, to provide individual or group tooth movements. While this combination and plan of appliances apply to the majority of cases, it will be understood, of course, that in some cases exceptions which include other arrangements must be made. However, in no instance are both labial and lingual arch wires ever placed upon teeth in the same dental arch. Figs. 4 and 5 show two stabilized lingual arch wires.

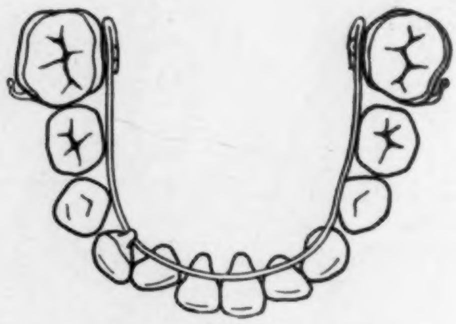


Fig. 4.

Fig. 5.

Fig. 4.—A removable lingual arch wire stabilized by banding one of the lower frontal teeth. A lug soldered to the band extends over the arch wire holding it more firmly in position.

Fig. 5.—A removable lingual arch wire stabilized by a frontal labial segment. This is carried at a higher horizontal level to prevent the incisors from tipping forward under anchorage stress, when such precautions are necessary.

Since all appliances should serve the purpose of establishing the teeth, dental arches, and jaws within the normal functional range promptly and with as little tissue disturbance as possible, it would seem desirable to keep their design simple, accessible, and easy of adjustment. That this may be achieved without subjecting patients to the hardship of banding all of the teeth in both dental arches (except in rare and unusual cases) has been demonstrated by many able clinicians, their aim being to follow the principle of utilizing attachment bands only upon those teeth or groups of teeth necessary for adequate control. In fact, many experienced orthodontists have shown that in the vast majority of cases a labial arch wire upon the maxillary teeth with controls upon the first permanent molars and the four incisors, employed in conjunction with a removable lingual arch wire upon the mandibular teeth, fully answers the requirements in all but exceptional cases. This is especially true when patients are made available for treatment at favorable age periods. By avoiding multiplicity of bands, erupting teeth in the lateral portions of the dental arches may take their places under guidance and establish that desirable relationship known as "normal approximal contact" without resorting to one of the more recent additions to the orthodontic armamentarium known as the "tooth positioner." Furthermore, by controlling the frontal and posterior segments of the dental arches, represented by the incisors and the molars, and establishing inciso-gingival relationship of advantage, intervening teeth may assume positions of

balance in the occlusal plane. These ideas and principles are illustrated in Fig. 6 where records of progress in a typical eugnathic anomaly as well as the appliances employed, are shown.

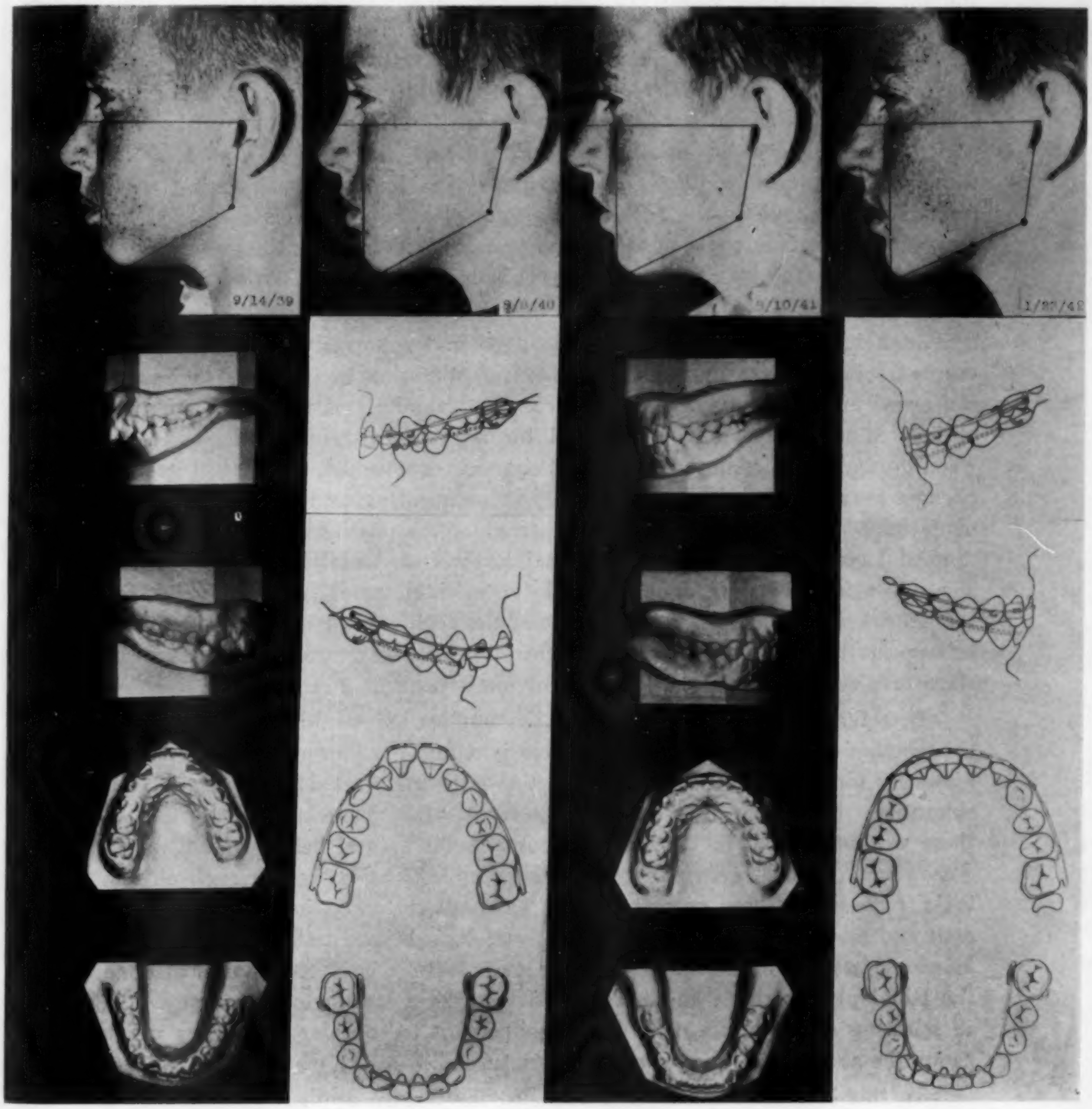


Fig. 6.—Records of progress in a typical case which include the appliances actually employed.

Through the proper application of sound principles of anchorage wherein force and resistance are carefully computed, there is no excuse for the distorted facial outlines now heralded under the title of "double protrusions," unless, of course, an appliance is employed whose action causes the teeth en masse to drift forward. Also, under the simple and direct methods advocated, the revival of that relic of medieval orthodontics, "the head cap" for applying extra-oral anchorage, has no place. Extraction in rare instances may be necessary as it has been from time immemorial, but this contingency lies in the field of

orthodontic diagnosis and should not be made necessary by the malaction of appliances.

We know from the Bolton Study, and from other sources, that normal dentofacial developmental growth from infancy to adulthood is an orderly continuous process but is less marked as maturity is approached. During this period the face continues to grow downward, forward, and outward, carrying the dentition with it. The nasion moves forward and slightly upward, the size of the orbit increases, its lower margin moving forward and slightly downward. The porion or ear hole moves markedly downward and backward as does also the mandibular condyle, while the premaxilla grows forward in harmony with directions of growth in the adjacent dentofacial area. There is a marked increase in the vertical length of the face, especially evident along the lower border of the body of the mandible, with the chin moving well out from under the brain case.

Such known records of growth changes under normal conditions should impress several facts; first, that our field of operation and all the structures concerned are in a state of change during orthodontic treatment; second, that periods of advantage may be selected for active treatment, to the end that when normal functional and anatomic balance is established, subsequent growth changes may be advantageously utilized in augmenting and rendering permanent the benefits of treatment. The period approximating the ninth year is deemed logical, providing developmental levels and dental age are favorable. The foregoing facts of dentofacial developmental growth also impress the thoughtful clinician with the importance of the health factor before, during, and subsequent to orthodontic treatment, for ill-health may profoundly effect the structures coming under the influence of our treatment measures.

In referring to the health factor, the implication would ordinarily imply the metabolic state of the patient. There is more to it, however, than this, for disturbed circulatory conditions within the oral structures deserve careful consideration. That these may ensue as the result of en masse appliances, that is, those working on all of the teeth of both dental arches, has frequently been demonstrated. That eventual recovery is possible is no excuse for such physiologic trespasses. Many an orthodontist has been fortunate in avoiding permanent end results which, to say the least, would be deemed unfortunate. We all know of instances where the roots of the lower incisors have been moved through the labial plate of bone and have failed to make a satisfactory recovery. So, in selecting an appliance, it is just as important to consider the things which should be avoided as those of a helpful nature.

In this brief survey of my preference for certain appliances, emphasis is given to the following: Simplicity of design makes possible ease of adjustment which reduces discomfort to patients and fatiguing effort to the orthodontist. Anchorage may be readily computed and controlled. Erupting teeth assume normal approximal contacts as well as positions of advantage and balance in the occlusal plane. The lower lip is not thickened from frictional contact against the usual multiple attachments upon the lower frontal teeth nor are other muscles unduly irritated and disturbed. Dentofacial anomalies involving the teeth, dental arches, and jaws may be promptly controlled and corrected. And, finally, the sustained cooperation of patients through the entire period of treatment is encouraged because such appliances are free from discomfort.

In conclusion, let me call your attention to the fact that the violin has but four strings and yet it is considered the supreme musical instrument; but to bring forth the harmonies of sound which have inspired men down through the ages requires skill and understanding. Those incapable of mastering it produce only disharmonies. So it is with appliances, and those incapable of the skill and understanding necessary to operate successfully appliances of simple design should seek other means even though they gain lesser awards.

THE PROBLEM OF EXTRACTION IN ORTHODONTICS

H. Berger, Dr. med. dent., Tel Aviv, Palestine

Man may infer the course evolution is bound to pursue from his observation of that which it has already followed, and he might devote his modicum of power, intelligence and kindly feeling to render its future progress less slow and painful.—*Francis Galton.*

CONTROVERSY IN RECENT LITERATURE

Among the problems which have continuously occupied the interest of orthodontists since the beginning of the century, there is none second to the question of extraction, and even a superficial survey of the more recent literature is sufficient to show that we are apparently far from a solution of this vexing problem. To illustrate the present state of affairs, a few controversial remarks of the last few years shall be quoted. We find, in the same issue of the International Journal of Orthodontia (November, 1937), the following divergent opinions:

Pro

In many cases, a satisfactory structural balance can be obtained only by the extraction of teeth, and the time is now past when it is necessary to make any apology for a means of treatment which is sound scientifically and in some cases a categoric necessity.

—*Andrew F. Jackson*

Con

I think it may be fairly said that the willingness to remove teeth depends more on the lack of skill and technical equipment of the operator than on any "scientific" judgment of the merits of the case under review.—*A. Thornton Taylor*

Interesting is the fact that sometimes both sides resort to the same argument:

Pro

In some cases we accomplish our end by restoring typical occlusion; in others by extraction, and in all cases by recognizing our dependence upon inherent functional processes, and the inevitable limitations imposed by the integrating factors of the *organism as as a whole.**

—*A. LeRoy Johnson*

Con

No one who has an eye with which to see can have failed to note the ruination of many faces by the extraction of teeth as an orthodontic procedure. When we see orthodontia in terms of the *whole individual** and not simply as a mechanical operation in the mouth, this pernicious practice will cease.—*John V. Mershon*

This paper was awarded the first prize in the S. S. Bloom Prize Competition which was arranged by the American Porcelain Tooth Co., Ltd., Tel Aviv, in cooperation with the Palestine Dentists' Association.

*Italics by the present author.

A paper by Strang was followed by a discussion between him and Howe:

Pro

We have two resources: To reduce the tooth material substance, or produce that disproportion. It seems to me that the orthodontic profession has been carried away altogether too much in the past by their false *ideals.** Malocclusion is usually a local expression of a general disturbance, and we are treating children who are not absolutely normal in physical development. Why then should we expect to get a normal denture in an abnormal face, in all cases?—*Horace L. Howe*

Probably, I am more in favor of extraction than I was fifteen years ago. . . . The fact that an individual or this society is investigating the subject does not make him an "exodontist," but marks him as an orthodontist with a broad outlook, and one who is anxious for the *welfare of his patients.**—*Harold Chapman*

Con

There are two sides to every question and, in reply to Dr. Howe, I will say, Thank God for *ideals!** Where should we be, had it not been for the fight that some men have waged for the preservation of ideals? Of course many of these individuals were considered to be extremists, but the truths that they taught are influencing and guiding us today. . . . Those men were and we, also, are willing to work for the welfare of a *specialty** that is, in reality, a science because it is founded upon one of Nature's great laws. We should not violate this law except under the most extreme conditions and circumstances. Therefore, and I state this with all the emphasis at my command, while we may err at times in preserving teeth, yet such mistakes cannot be compared with the deliberate and planned mutilations that are in evidence as a result of the routine treatment of malocclusion by the extraction of teeth.—*Robert H. W. Strang*

I have contrasted Strang's final remarks with a sentence by Chapman since both of them show a feature which the psychologist calls "special pleading." Such appeals to the sentiments of the hearer ("ideals" and "welfare of the specialty" on the one side, "welfare of the patients" on the other) are only apt to demonstrate that strictly scientific arguments are not thought strong and convincing enough to influence the opinion of the audience.

THE PRESENT TREND

Before trying to apply a more sober and dispassionate treatment to our problem, we will have still another look at our literature in order to see whether, perhaps, after all, some trend or tendency is discernible, favoring one side or the other. One gets the impression that there is such a tendency. Chapman's statement that he is now "more in favor of extraction than fifteen years ago" has just been quoted. Mershon, in one of his latest publications, though still generally opposed to extraction, writes that "aside from the extraction of third molars, only a very small percentage of our cases warrant extraction as a remedial measure." This cautious statement may be taken as a slight concession and as some sign of change in Mershon's former more rigid attitude. Even Strang, whom we have found above among the most ardent opponents of extraction, publishes in 1943 a case which he has treated according to Tweed's principles, and here two lower cuspids have been "eliminated."

Finally, we find in the October, 1943, issue of the American Journal of Orthodontics an editorial by Milo Hellman, "At the Crossroads," which contains the following sentences regarding extraction: "Lately, it has flared up again with considerable vigor, and judging from the enthusiasm with which

*Italics by the present author.

it is being spread, the indication is for a long endurance. Unlike previous recurrences, the current surge is swelled by those who were among the most faithful and devoted followers of the Angle tradition. The significance of a situation of this sort is of concern to some and confusing to others.'' Though it must be concluded from the tone of this editorial that Hellman himself is now, as before, strongly opposed to extraction, we can hardly imagine a better and more authoritative appraisal of the prevailing trend. The pendulum is certainly swinging toward extraction.

THE HISTORY OF THE PROBLEM

It is generally advantageous to have some knowledge of the history of a problem under discussion. In our case this history is, fortunately, not a long one and covers scarcely forty years. For all the cases which have been treated or have not been treated by extraction before this time do not pertain to the present conception of the ''problem of extraction.'' The problem as we understand it today starts with Angle's promulgation of the ''law of harmony,'' and with the establishment of ''normal occlusion'' as the principle governing orthodontic concepts and procedures. Since ''normal occlusion'' implies the ''full complement of teeth,'' therefore came Angle to his anathema against extraction. According to Angle, ''the best balance, the best harmony, the best proportions of the mouth in its relations to the other features require that there shall be the full complement of teeth, and that each tooth shall be made to occupy its normal position—normal occlusion." He establishes the principle that ''the full complement of teeth in normal occlusion is essential to the proper typal proportions of any face.''

There will be ample opportunity to show later whether these categorical statements and claims are justified or not. But the author's firm conviction shall have been expressed on this occasion that, but for the enormous prestige of Angle and but for the devotion and continuous adherence of his disciples to his teachings, and theories, the problem of extraction should by now have lost much if not all of its ''problematic'' character and it would never have influenced the course of orthodontic development in such a nearly magic way.

THE THREE KINDS OF EXTRACTION

Finally, approaching the treatment of the theme proper, it seems to the author that the problem might be simplified if we discriminate between the following three kinds of extraction: (1) Extraction in place of treatment. (2) Extraction as aid to treatment. (3) Extraction as necessary part of treatment.

1. The first class would comprise cases which cannot be orthodontically treated for some reason or other: e.g., there may be economic difficulties; or the patient may dwell in some remote locality and cannot undertake the long and frequent trips necessary for treatment; or the dentist concerned may lack the necessary skill and qualifications for the indicated treatment. Cases of this kind do not fall within the scope of the problem as it is envisaged here, and therefore, need not concern us further.

2. The second class is to contain cases in which extractions are performed in order to simplify a treatment which, otherwise, is regarded as too complicated by the dentist, or for which the patient has not the required means or time, or for reasons of age. Cases of this kind, too, need not be discussed here, though, sometimes, there may be borderline cases which crop up in our practice,

3. There remains for our consideration the third class, and, thus, our problem boils down to the question: *Are there really anomalies in which extractions are a necessary part of treatment under any circumstances, and for what reasons?*

THE THREE CAUSES OF DISRELATION

Time and again, orthodontists, in support of extraction, have referred to disrelations between the size of the teeth and that of the jaws, and they have, generally, explained it as a coincidence of the big teeth of the father in the small jaws of the mother. This explanation has been violently opposed by those who condemn extraction. We have to concede today that this conception was somewhat primitive, though, as will be shown, of recent years some interesting support has come forth even for this argumentation. But equally primitive and without scientific foundation was Angle's statement: "An interesting fact, which the author also believes to be convincing proof of what has already been said relative to harmony of facial lines depending upon harmony of occlusion, is the wonderful harmony of facial types with the types or pattern of the teeth: how the broad and squarish type of tooth harmonizes with a similar type of face; how the long and narrow type of tooth is found to accompany a similar type of face. . . . The proof of Nature's wonderful harmony of the tooth patterns with the type of the individual may be strikingly impressed upon anyone who will try to match a tooth lost from a skull with teeth of other skulls."

Of course, harmonies like these do occur and they strike us as "normal." But our whole conception of "normality" has undergone significant changes during the last few years. What was formerly regarded as "normal" is now more cautiously referred to as "ideal"; and it is rather seldom that ideals materialize. But even if we are inclined to concede to harmonies the status of "average," there still remain the "variations," the exceptions; and it is, unfortunately, these exceptions we are so often called upon to treat. Modern science now allows us to attack the problem from other viewpoints than those of Angle who approached the problem rather as an artist and who, typically enough, dealt with the whole question in a chapter: "Facial Art."

In the light of modern knowledge we can discover three possible causes of disrelation: (1) Disrelation on a pathologic basis. (2) Disrelation on a constitutional-hereditary basis. (3) Disrelations on a phylogenetic basis.

Disrelations on a Pathologic Basis.—Disrelations on a pathologic basis can be dealt with rather cursorily. There are children who, in early life, have undergone protracted periods of severe illness and who, in consequence of this, suffer from arrested development from which they never wholly recover. But though diseases affect the growth of the body, they never have any influence upon the size of the teeth, which is entirely determined by hereditary factors. Only their structure may be modified by environmental causes as, e.g., in case of rickets. (A possible exception is congenital syphilis which can cause dwarfism of single teeth though not of the whole denture.) This difference in developmental pattern, therefore, leads to disharmonies in cases of severe illness, i.e., on a pathologic basis. Since cases of this kind are easily revealed by the past history of the patient, they should not offer much difficulty in tracing the etiology of the disharmony, and need no further discussion. The same holds true of cases of stunted growth which are caused by endocrine disorders as, e.g., hypothyroidism, hypopituitarism, or juvenile diabetes.

Disrelations on a Constitutional-Hereditary Basis.—In contrast to the disrelations on a pathologic basis we shall encounter some difficulties when analyzing the possibility of direlations on a constitutional or hereditary basis. First of all, it is very difficult if not impossible to differentiate between constitution and heredity. They are intertwined as are growth and development, which we are by now accustomed to meet always together like a pair of inseparable twins. And since no advantage will result from such a differentiation, no attempt in this direction will be made.

We have already stated above that the size of the teeth is determined by hereditary factors and not influenced by environment. Now, there is no doubt that the size of the jaws, too, is primarily determined by heredity, though it may, to some degree, become modified, together with the rest of the body, by environmental factors. The question now arises whether, apart from those modifications, there exists perhaps a correlation between the size of the teeth and that of the jaws, so that disrelations on a hereditary basis would not occur. As a matter of fact, thoughts like these have usually been expressed by the opponents of extraction. They are, however, inconsistent with the findings of modern hereditary research. According to the accepted principles of heredity, every inheritable character is carried in a gene, and the new individual receives for each character two genes, one from each parent. These two genes do not blend in the new individual, though this impression may be gained from the external appearance of the individual (phenotype as against genotype). During propagation the genes separate once more, and thus it is possible that a character which was not visible because of its recessivity and its being obscured by the dominance of the other gene (allelomorph) again makes its appearance in the new generation. An instance of this kind in man is the dominance of brown eye color over blue.

The mentioning of eye color will recall to our mind that we, very often, find blue eyes in combination with fair hair and a light complexion, and vice versa. Observations like these may have led to the supposition, reported above, that, as to their size, teeth and jaws are combined in the hereditary process. Now it is a fact that there are such combinations for which the scientific term is linkage. A linkage is defined and explained as a tendency of certain genes to remain associated through many generations because of their being carried in the same gene. But it has still to be proved that such a linkage exists between the size of the teeth and the size of the jaws. Quite on the contrary, it seems very improbable. For though teeth and jaws are in local proximity, they are far apart as to their embryologic origin: the teeth are derived from the ectoderm, the jaws from the mesoderm. But even if such a linkage should exist against all probability, a linkage is only a very strong combination, it is by no means permanent or indissoluble. A linkage may split up, part of its components going this way, part that way. For this phenomenon, too, exists a special and very characteristic term: crossing-over.

After this rather sketchy outline of the theory of heredity, we will turn to the practical side and see whether there are experiments and investigations which are apt to help us further in our study. As to experiments, we are in the fortunate position of being able to draw on the work which Stockard has done on the crossbreeding of different races of dogs. The implications of this work with respect to dentistry and orthodontics have been presented and analyzed in the AMERICAN JOURNAL OF ORTHODONTICS only a few years ago by LeRoy Johnson and need not, therefore, be repeated here in detail. Only

the following extracts shall be quoted since they pertain particularly well to the problem under discussion: "The size of the dental arch shows a far greater fluctuation than does the size of the teeth. . . . A very important point for the orthodontist to note is that, as the snout becomes shorter, the teeth are not correspondingly reduced in size. They are crowded, rotated, and faulty in alignment and occlusion. Where the snout is short, the teeth are too large for the jaw. . . . The assumption so often expressed in orthodontic literature that the hereditary tendency of all organisms is to develop the entire skull in harmonious design typical for the species, and that all departures from the typical are solely the result of environmental influences, is without scientific justification. That there may be a natural disharmony between the amount of tooth material and their supporting structures is a fact substantiated by the evidence here presented." These findings do not leave us in any uncertainty about the possibility of anomalies arising on a hereditary basis. Of course, crucial experiments like these can only be made with animals. But there is no reason to doubt that the same hereditary laws govern man's hereditary mechanism, too. It is interesting to note that only a few years ago (1935) an authority of the rank of Ales Hrdlička could still write the following sentences:

"A cause not seldom invoked in cases of malocclusion is a differing heredity in the size of the jaws and the teeth, the conception being that in cases of mixtures where these parts differ markedly in the two parents, the children may inherit large teeth from one with small jaws from the other parent, or other disharmonic conditions. These are assumptions backed by no scientific determinations. . . . There are innumerable hybrids between the whites and the Negro, the whites and the Indian or Eskimo, and between other races; yet no disharmonies are perceivable in any of these, under normal conditions. Only when abnormal states and pathologic conditions affect the jaws or teeth, will discordances manifest themselves."

To this, I think, the following statement by Davenport and Steggerda, though written in 1927, is an appropriate reply:

"The evidence of Mendelian inheritance in man is, indeed, so overwhelming and has been so long known that reference to it here might seem unnecessary, were it not that, occasionally, anthropologists arise who appear to be skeptical on the matter."

But we need not content ourselves with statement versus statement, since reliable investigations furnish us with irrefutable facts. Before going into the details of teeth and jaw relations let us consider some general observations made in hybrids. In Fischer's investigation of Boer and Hottentot hybrids we find that there occurs kinky hair in light color. This shows that the hair *form* may be inherited from one parent, and hair *color* from the other. Likewise nose and ear are composed of different parts which are transmitted separately and can reunite in various combinations. Bond reports cases of Negro-white crosses in which wavy and kinky hair appears in the same individual, the hair being wavy on the vertex and kinky on the sides of the head. *Fleming,* in a study of children from a Chinese father and an English mother, describes a child with different eyes, one with Mongolian fold, orbit shape, and eye color, the other with a light gray-brown English eye. *Bryn* has found that luxatio coxae is very frequent in the hybrid population of Finmark compared with other parts of Scandinavia and is of the opinion that the small pelvis and narrow acetabulum of the Lapp woman combined with the large caput femoris of the Norwegian makes luxation easy and can be regarded as a disharmony arising from this cross.

Under these circumstances, it would be a curious exception, indeed, if jaws and teeth were not to suffer from the consequences of race crossing as is Hrdlička's assumption. The following observations, however, provide us with a definite answer. Davenport has, as early as 1917, called attention to the fact that, in the American populace with its strong race intermingling, individuals are frequently met with who show either spaces between small teeth in spacious jaws or big teeth crowded in small jaws, whereas skulls of primitive peoples of pure race usually have even rows of teeth. He regards these disharmonies as consequences of crossing between races with big teeth in broad jaws and races with small teeth in narrow jaws.

Gates in his work *Heredity in Man* writes in the chapter about "The Effects of Racial Crossing":

"In the newer countries, such as North and South America and parts of Africa, the crossbred races which have sprung up through miscegenation between Europeans and more primitive peoples are at a disadvantage from every point of view. Besides the social failure of adjustment, physical disharmonies result, such as the fitting of large teeth into small jaws or serious malocclusion of the upper and lower jaw."

Abel, in 1931, has published "Investigations about the Separate Inheritance of the Size of Teeth and Jaws in Hybrids of Bushmen, Hottentots and Negroes." From his material I only want to quote the following passage:

"The great differences in the form and size of the jaws and the teeth have made it possible to explain, especially in three cases, the lack of space by mixture of a small Hottentot jaw (in one case) and Bushmen jaws (in two cases) with large Negro teeth. In another case are, on the contrary, the small teeth of a Hottentot distinctly to be found in a broad Negro jaw. In the first three cases anomalies of the denture had arisen through lack of space. Thus in one Hottentot-Negro hybrid the left lower incisor was displaced and an extensive anomaly of the permanent denture had resulted especially in the incisor and cuspid region. In two Bushmen-Negro hybrids, once in the lower jaw and once in the upper jaw, the cuspids of both sides have been prevented from erupting and have been retained in the jaw. Besides these most important cases of lack of space, several other instances of malpositions and torsions of cuspids and incisors were to be found."

Abel, therefore, comes to the conclusion that the size of the jaws and that of the teeth are inherited in a separate way.

Fleming,* whose findings in Chinese-English crosses have already been reported above, has also paid special attention to the occurrence of malocclusions in hybrids. She found disharmonies in 10 per cent of 110 cases of white-Negro crosses. In 47 cases of backcrossing white-Negro to white, 9 cases of disharmonies occurred. On the other hand, she found only one anomaly among 119 cases of white-Chinese hybrids, and this she explains by the fact that the Chinese jaw is much nearer in type to that of the white than is the Negro jaw. The following is the description of two characteristic cases of this very interesting material:

"The palate was rounded and well-arched and the upper teeth large, square and well-spaced; the lower jaw, however, was small, badly-arched and its teeth crowded. The resulting post-normal occlusion was very marked and interfered somewhat with speech.

*Personal information from Miss Fleming, quoted with her permission.

"A small V-shaped palate with small upper teeth; the lower jaw was widely arched and the lower teeth were large and long. The resulting pre-normal occlusion was so great that the lower teeth slipped up outside the upper lip. Speech was so badly interfered with that it was unintelligible."

It will be argued that cases of race mixture as described above are relatively rare and, therefore, not of much consequence for us. But it is not the history of these cases which interests us but the principle they are apt to demonstrate: the principle that teeth and jaws are inherited separately and that parts which are derived from highly different types do not always combine in such a way as to form a new harmonious whole. And when speaking of "types" in this connection, we have not so much *racial* types in mind as *constitutional* types. For it is a well-known fact that different and contrasting types occur even in relatively pure races.

I have stressed the importance of constitutional types for orthodontics on previous occasions at some length so that I may here content myself with giving a very short outline.

Fig. 1.

Figs. 1 to 5.—Anomalies of the "crossing-over" type in a pair of twins.

Generally, two types have been described under various names and it does not matter whether we still adhere to the nomenclature of Kretschmer who uses "leptosomic" and "pyknic" (his third type, the "athletic," has become somewhat problematical of late and need not be gone into in this context), or whether we follow Weidenreich, who speaks of "leptosomic" and "eurysomic," or Stockard, whose terms are "linear" and "lateral." All these classifications are based upon the fact that there are individuals of a high and narrow build and others of a short and broad one. Assuming normal and harmonious types, we should find narrow-type teeth within narrow jaws in the slender individual and broad jaws with broad-type teeth in the stocky one. But on the strength of our foregoing investigation we cannot be in doubt as to the fact that human features are *not* inherited as a whole. On the contrary, they split up and re-

unite rather haphazardly in order to form a more or less harmonious new combination. Thus it may happen that a slender individual finds himself with broad teeth, for which his slender narrow jaws do not provide sufficient room, and under reciprocal conditions diastemas will result. Though Fig. 1 does not exactly portray a slender as opposite to a stocky boy, I cannot imagine a better example to illustrate the case and corroborate our notion. A superficial glance at the picture will convey the impression that we have to do with two boys with an age difference of about one to two years. But the fact is that these two boys are twins, and the difference in stature is not due to age but to type. The boy on the left is a true representative of the pyknic type, whereas the other one represents the "type cérébral" of the French constitutionalists. This type is essentially characterized by the contrast between a well-developed brain skull

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

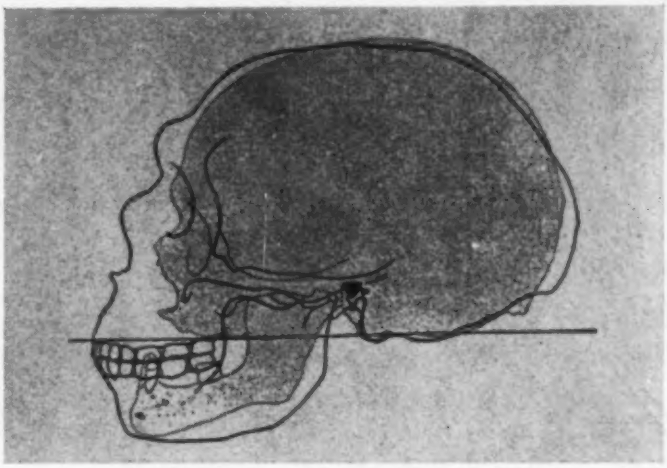
and forehead on the one side and a low and flat face together with a small body which appears somewhat underdeveloped, on the other. This type which sometimes produces features of infantilism in adults is not so easily diagnosed in children as is the leptosomic or pyknic type. And though this type is not so frequent as the two main types, it is, nevertheless, of real importance for orthodontic diagnosis and treatment and, together with the above-mentioned athletic type, should serve to supplement the other ones as secondary type. Returning to our picture, we see within one pair of twins the contrast between a big pyknic

boy and a small one of the cerebral type. And if we now direct our attention to the dentures we see in the big boy the teeth evenly spaced as we should expect to find them at this developmental stage ($5\frac{1}{2}$ years). In the small boy, however, the teeth do not show any spaces, a fact which, even under normal circumstances, should not augur well. But, having diagnosed the type, conditions may not be regarded as normal, and when we now proceed to Figs. 4 and 5, we shall learn what happened during the eruption of the incisors. Fig. 4 shows the cast of the big brother. He has inherited small teeth and, therefore, the spaces of the deciduous dentition have not disappeared but are persisting in the permanent dentition owing to the excess of room offered by the broad and spacious jaw. The small brother, however, has inherited broad teeth which would have excellently suited the big brother but, in his small jaws, do not find sufficient room. His cast (Fig. 5), therefore, shows us the beginnings of an extreme crowding. Each of these cases is an example of disharmony in itself, but taken together we are reminded of the term "crossing-over" which we encountered when dealing with hereditary principles. Though we cannot dare to regard this case of twins as a true case of "crossing-over" in the strict cytologic sense, we might perhaps be allowed to speak of cases like these as of a "crossing-over type." Such a term would offer not only a pregnant description, but would at the same time classify it as to its etiology: Disrelation on a constitutional-hereditary basis.

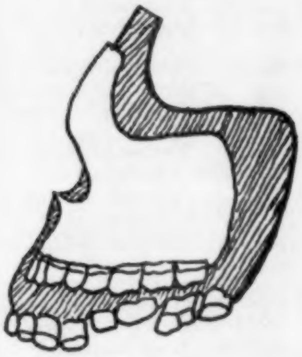
The Phylogenetic Basis of Disrelations.—It is a well-known fact that, in the course of evolution, the human jaw has undergone a marked reduction. It has often been stated, likewise that the reduction in the size of the teeth has not been so great. But though some features of our present-day dental conditions have repeatedly been attributed to this discrepancy, as, e.g., the manifestations connected with the eruption of the third molars, up to now no investigation has come to our knowledge which has worked with exact figures to corroborate these assumptions. Usually the object is covered by vague and generalizing phrases. It is the opinion of the author that the new material which has been unearthed during the last few years—especially on Mount Carmel (worked upon by Sir Arthur Keith and McCown) and in China (published by Weidenreich)—encourages and facilitates such an attempt. It is certainly but a matter of time before a thorough and authoritative treatment of this question will be undertaken. Since this question, however, is of importance for the problem under discussion, I shall try here to give a preliminary survey from the material at my disposal.

Easy though it is to get and compare measurements of the teeth, a certain difficulty arises if it is intended to give an idea of the reduction of the jaws by means of measurements. Everyone who has the possibility of looking at a palaeolithic skull placed beside a modern one will be struck by the enormous development of the regions of the middle and lower face and especially of the jaws in the former, which still remind us of the muzzle of primates. Fig. 6 *A*, shows the lateral views of a modern skull and the skull of the so-called "Old Man of La Chapelle-aux-Saints." This skull worked upon and reconstructed by Boule is generally regarded today as the prototype of Neanderthal man who lived about 40,000 to 60,000 years ago. The same age is attributed to Rhodesian man whose upper jaw is contrasted with a modern one in Fig. 6, *B*. Still more interesting will be a comparison of a modern mandible with the Mauer jaw *(H. heidelbergensis)* to which an age of about 200,000 years is assigned. It is the most powerful of all fossil mandibles and it would generally

have been regarded as simian but for the dentition which is of definitely human character. In Fig. 7 I have arranged Schoetensack's original diagrams of this mandible and a modern one in such a way as to give a clear impression of the changes which have taken place. This visual impression shall be supplemented by a comparison of the measurements of this mandible and a modern one as compiled by Hrdlička. In order to make the differences more striking I have computed the percentages by which the measurements of Heidelberg man exceed those of the modern one. But when looking over those percentages (Table I, Column 3), it should be borne in mind that we have not to do with lines or



A.



B.

Fig. 6.—*A*, Comparison of a modern skull with that of "La Chapelle-aux-Saints." (After Boule.)
B, The upper jaw of an English skull superimposed on the Rhodesian jaw. (After Keith.)

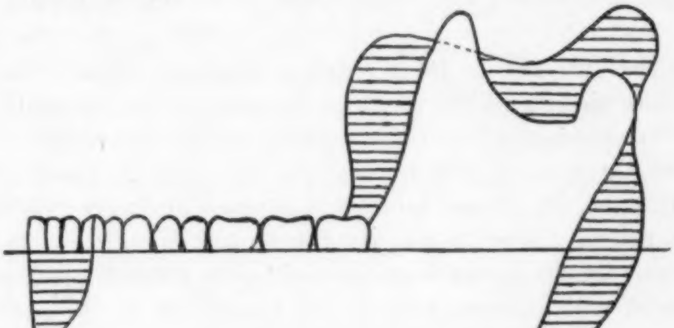


Fig. 7.—Comparison of the Heidelberg mandible with a modern one. (Schoetensack's original diagrams, rearranged by the author.)

a plane but with a three-dimensional body. Therefore, these figures should not only be compared separately, but—mentally—some kind of multiplication should be tried. The best method of comparing the mandibles, of course, would be to determine their masses. Unfortunately, such figures do not exist, and, therefore, we have to content ourselves with the pictures and measurements given above.

We may get some further idea of the changes which have taken place by comparing the measurements of the bizygomatic breadth. It has been shown

TABLE I. COMPARISON OF THE HEIDELBERG MANDIBLE WITH A MODERN MANDIBLE

		HEIDELBERG MANDIBLE RIGHT LEFT (MM.)	MODERN GERMAN MALE RIGHT LEFT (MM.)	AMOUNT BY WHICH HEIDELBERG MANDIBLE SURPASSES MODERN MANDIBLE (%)
Total med. length of whole bone (from anterior vertical to middle of baseline of plane formed by applying a plank to posterior borders of the rami)		close to 10.5	7.5	40
Length of jaw (from the most anterior point of the alveolar border between the median incisors to a point at corresponding height on the posterior border of ascending ramus		12.5 12.1	9.1 9.0	37
Breadth:	Bigonial	10.8	10.0	8
	Bicoronoid	11.3	9.8	15
	Bicondylar	13.1	12.2	7
Ramus:	Height, mean	6.85	6.5	5
	Breadth, minimum, of ascending ramus	5.1	2.75	85
Corpus:	Vertical height of bone at symphysis	3.5	3.4	3
	Vertical height of bone at first molar	3.4 3.3	2.9 2.9	17
	Vertical height of bone at second molar	3.25 3.1	2.8 2.8	15
Thickness of body (at right angles to vertical diameter of same) in median line, midway from above		1.8	0.9	100
Thickness, maximum, in median line		2.5	1.5	67
Thickness, maximum, opposite Pm_1		1.95 2.0		
Thickness, maximum, opposite M_1		1.85 1.9	1.45 1.5	27
Thickness, maximum, opposite M_2		2.05 2.08	1.5 1.55	30
Thickness, maximum, opposite M_3		2.25 2.25	1.5 1.5	50

Measurements in Columns 1 and 2 after Hrdlička. Percentages in Column 3 by author.

repeatedly by the author that there exists a close and measurable relation between this measurement and the width of the palate: the breadth of the upper alveolar arch (measured between the centers of the first molars) is one-third of the bizygomatic breadth. There are not so many measurements available for fossil skulls since the zygomatic arch is exposed and very fragile and, therefore, mostly damaged. Nevertheless, the few figures compiled in Table II will be sufficient to show which values were prevailing in palaeolithic times, and they can be compared with modern averages as computed by the author from 250 children under orthodontic treatment. In order to make these latter measurements comparable with the other ones, correction for age has been made individually, and 7 mm. have been deducted generally for the thickness of the covering tissues. It will be seen that the bizygomatic breadth of the fossil skulls surpasses the modern one by 15 to 20 per cent on the average, and from this we may conclude how much the width of the bony base upon which the alveolar arch rests has been reduced. To this reduction in width we have to add the reduction in sagittal direction which must have taken place approximately in conformity with that of the lower jaw, described above.

It is on purpose that we have not quoted any measurements of the alveolar arches, since these, of course, are influenced, to a certain degree, by the size of the teeth and, therefore, apt to confuse the picture. To these measurements of the teeth we have now to turn our attention. In Table III have been arranged measurements in mediodistal and labiolingual direction of modern and

TABLE II. BIZYGOMATIC BREADTH IN PALAEOLITHIC MAN AND ORTHODONTIC PATIENTS

HOMO RHODESIENSIS	LA CHAPELLE-AUX-SAINTS	GIBRALTAR (FEM.)	MOUNT CARMEL PEOPLE				ORTHOD. PATIENTS	
			TABUN I (FEM.)	SKHUL			BOYS	GIRLS
				IV	V	IX		
148	153	140	(130)	160	145	140	133.3	126.4

Measurements in millimeters.

TABLE III. DIAMETERS OF TEETH IN RECENT AND PALAEOLITHIC MAN

	TEETH	MEDIODISTAL					LABIOLINGUAL				
		REC. MAN	HEIDELBERG M.	TABUN MAND.	KRAPINA	MOUNT CARMEL	REC. MAN	HEIDELBERG M.	TABUN MAND.	KRAPINA	MOUNT CARMEL
UPPER JAW	I_1	6.9 10.6			9.9 10.4 11.0	8.5 9.8 10.9	5.6 8.8			8.0 9.1 9.4	7.5 8.2 8.7
	I_2	5.0 8.0			7.5 8.4 8.9	6.2 7.4 8.8	5.0 8.4			8.6 9.1 9.5	6.2 7.6 8.8
	C	6.3 9.0			9.0 9.5 10.5	7.5 8.3 8.9	6.4 10.0			9.5 10.3 11.3	8.0 8.9 9.6
	P_1	6.2 8.2			8.0 8.5	7.4 7.8 8.7	7.8 11.0			10.5 11.4	9.8 10.2 10.8
	P_2	6.0 7.5				6.5 7.3 8.4	7.6 10.4				8.4 10.0 11.0
	M_1	7.8 11.2			10.0 13.3	9.9 11.2 12.4	10.4 13.0			11.6 13.3	11.2 11.9 12.5
	M_2				10.0 12.0	8.6 10.1 12.2				11.2 14.0	11.4 11.9 12.3
	M_3				10.0 12.2	8.3 8.9 9.4				12.0 12.5	10.2 11.1 11.8
LOWER JAW	I_1	4.7 6.3	5.0- 5.5	5.9	6.2	4.5 5.4 6.5	5.2 6.8	7.1	8.0	8.1	6.4 7.1 8.0
	I_2	5.0 7.2	6.0- 6.3	6.1	7.5	6.0 6.6 7.2	5.4 7.2	7.7-7.8	8.2	8.2	7.0 7.8 9.0
	C	5.5 8.0	7.6- 7.7	8.0	7.5 8.4	6.4 7.7 9.1	6.9 9.5	9.0	9.0	8.2 10.0	7.0 8.3 9.0
	P_1	5.2 6.6 8.1	7.3- 8.1	7.8	7.8 8.3	5.8 7.2 8.2	6.7 8.9	9.0	9.0	8.5 10.0	7.7 8.5 9.2
	P_2	5.2 6.9 9.0	7.5	7.9	8.3 8.5	5.9 7.3 7.9	7.0 9.6	9.2	9.5	9.5 9.9	8.3 8.8 9.5
	M_1	9.2 11.1 13.3	11.1-11.6	11.0	11.2 13.8	10.0 11.4 13.0	9.0 11.0	11.2	11.0	10.5 12.4	10.0 10.9 11.5
	M_2	8.5 10.7 13.9	12.7-12.9	10.8	10.7 12.5	9.5 10.7 11.6		12.0	11.0	10.3 11.4	10.0 10.7 11.4
	M_3	7.8 10.7 13.8	11.5-12.2	11.5	11.1 13.6	10.3 11.1 12.2		10.9-11.3	10.8	10.0 11.0	9.7 10.2 10.8

All measurements in millimeters.

Two measurements in a space represent minimum and maximum; three measurements: minimum, mean, and maximum.

The Krapina measurements are according to Gorjanovic-Kramberger, but the mean values for the upper front teeth are computations by McCown and Keith.

The column of Mount Carmel measurements is compiled by the author and the mean values have been computed by him. The original figures by McCown and Keith have been used.

For further explanation see text.

palaeolithic teeth. The figures for modern teeth are according to Mühlreiter, but for the lower premolars and molars figures have been inserted which were published by De Jonge-Cohen and which are based upon more than 7,000 teeth of the recent Amsterdam population (collection of Professor Bolk). Columns 2 and 3 contain the measurements of the teeth of the Heidelberg and Tabun II mandibles. The Heidelberg mandible is the most powerful of all fossil human mandibles, as has already been stated above, and the Tabun II mandible from the Mount Carmel excavations comes very near to it, and it is, according to McCown and Keith, overshadowed by the Heidelberg jaw only. A glance at the first three columns now will show us that the teeth of these most powerful mandibles fall completely within the range of variation of recent man's teeth and, sometimes, even coincide with their mean values. It is only the labiolingual measurements and especially those of the incisors* which surpass the highest modern values, and from this we may conclude that any reduction which has taken place has affected not so much the breadth of the teeth as their thickness. But the thickness of the teeth has a negligible influence on the form and size of the dental arch. Orthodontists in their practical work never pay any attention to this dimension and, therefore, after having noted this interesting phylogenetic feature, we need not further concern ourselves with it.

TABLE IV. SUM OF MEDIODISTAL DIAMETERS OF MANDIBULAR TEETH IN PALAEOLITHIC AND RECENT MAN

	RECENT MAN	HEIDELBERG	TABUN II	KRAPINA	MT. CARMEL
Minimum	51.1			70.3	58.4
Mean	64.4	70.3	69.0	74.6	67.4
Maximum	79.6			77.8	75.7

To make a more exact comparison of mandibular teeth measurements, Table IV has been compiled by the author, demonstrating the sum total of the mediodistal diameters. For recent man, Krapina man, and Mount Carmel man, the sum total of minimum, mean, and maximum values has been calculated. It results from this table that the Heidelberg and Tabun II totals fall within a 10 per cent range of the recent mean and are much nearer to the recent mean than to the maximum. On the other hand, the totals of these most powerful mandibles, known today, are but slightly higher than the Mount Carmel mean and lower than the Krapina mean. (The seeming paradox of the recent maximum being greater than the palaeolithic one is explained by the fact that the great number of investigated recent teeth has resulted in a much larger range of variation, more than 20 per cent, than in the palaeolithic teeth where the range of variation is only 5 per cent of the Krapina mean and 12 per cent of the Mount Carmel mean. The addition of new material from future discoveries would certainly lead to an extension of the range of variation in both directions, whereas the means would be not at all or but slightly changed.) Trying to come to some general conclusions from the perhaps embarrassing mass of contrasting figures, we may state: As early as in the times of the lower and middle palaeolithic era there existed a range of variation in the size of the teeth, and we find in Krapina a decidedly macrodont group of man and on Mount Carmel a but moderately macrodont group. Futhermore, we find relatively small teeth in very strong mandibles, and this means that already in these early times big teeth and big jaws did not always go together.

*It is perhaps worth noting that it is also the thickness in the incisor region of the corpus mandibulae which has been most strongly affected by reduction.

The phenomenon of disrelation might even in Neanderthal man lead to anomalies which we used to connect with lack of space in recent man. Thus we find typical crowding of incisors in the La Quina specimen where very powerful teeth are linked to relatively small jaws, and the youth of Le Moustier has an impacted lower cuspid, the corresponding deciduous cuspid persisting, and a half-impacted lower third molar, the medial edge of which is tipped against the neck of the second molar. But these instances are rare exceptions and not, as it is today, nearly the rule. Generally there is not only sufficient space but excess of space, and, but for this latent reserve of space, present-day dental conditions might be still more tense than they are.

If we recall that the length of the modern mandible is by 3 cm. smaller than that of the Heidelberg mandible, whereas the total of the mediodistal diameters is only about half a centimeter less, then we have to ask ourselves: Where did the difference of 2.5 cm. come from? Now, in nearly all fossil mandibles, we can observe a vacant space of about 10 mm. between the third molar and the ascending ramus. The use of this reserve of space lessens the difference to some extent. Another addition of space has accrued from the reduction in the width of the ascending ramus which has decreased from 5 to under 3 cm.

This decrease in width is especially high at the level of the alveolar plane, and thus further space was gained for the backward extension of the dental arch. Nevertheless, as we know, do all these favorable instances not offer sufficient compensation for the general reduction which has taken place in the mandible, and, therefore, we find the great number of impacted third molars in modern man. This condition must be attributed to Nature's failure to reduce the size of the teeth at a degree which corresponds to the reduction of the jaws. Nature, as we repeatedly observe, has tried to make up for this failure, by reducing the number of the teeth. But the phenomenon of lacking teeth—lateral incisors, second premolars, and, especially, third molars—is not yet so general as to alleviate the present state of disrelation in a marked degree. We, however, when treating cases of disrelation, shall do well by taking Nature's cue; for, though we cannot reduce the *size* of the teeth, we are well able to reduce their ***number***.

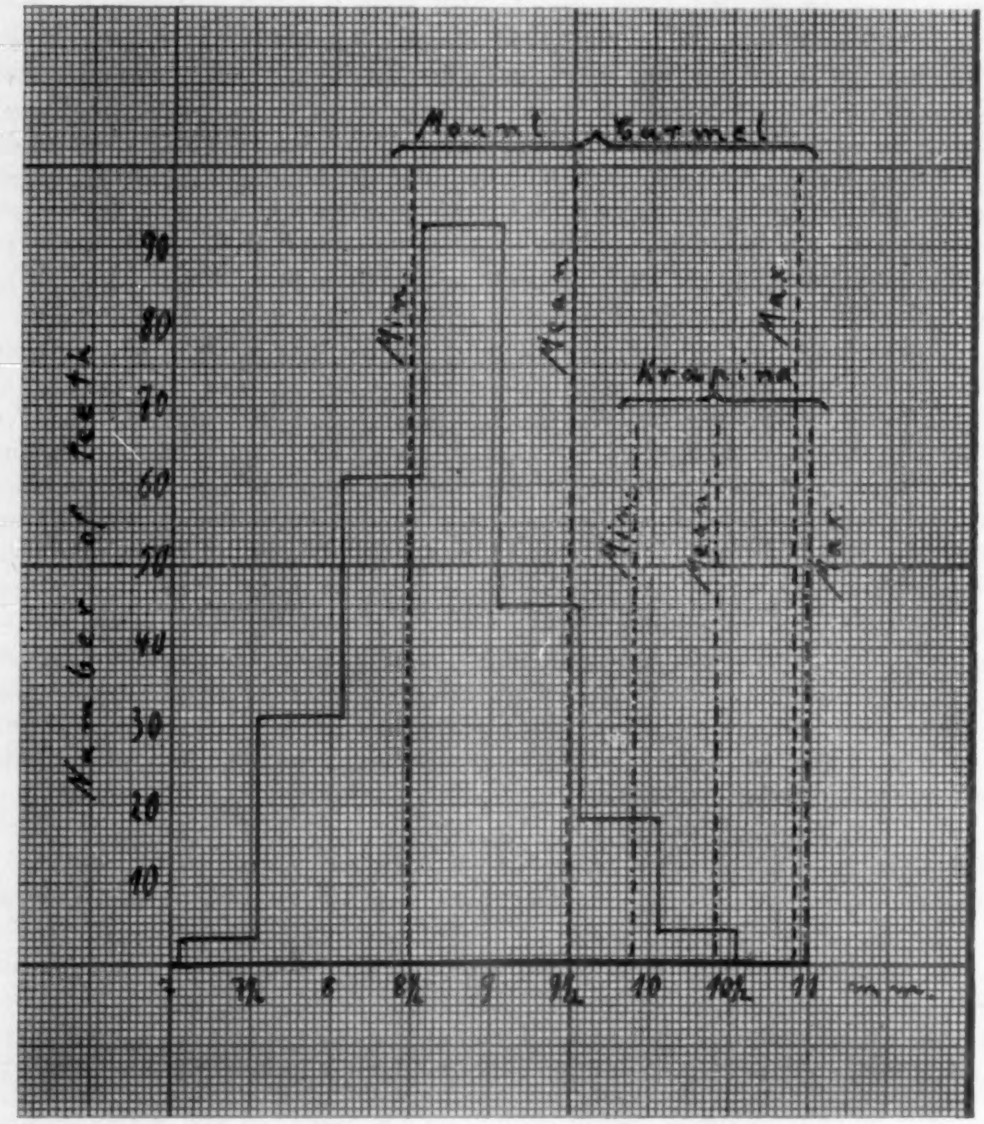
TABLE V. MEDIODISTAL DIAMETERS OF UPPER INCISORS IN PALAEOLITHIC MAN AND IN ORTHODONTIC PATIENTS

	CENTRAL INCISOR			LATERAL INCISOR			SUM OF THE 4 UPPER INC.		
	KRAPINA	MOUNT CARMEL	ORTH. PAT.	KRAPINA	MOUNT CARMEL	ORTH. PAT.	KRAPINA	MOUNT CARMEL	ORTH. PAT.
Minimum	9.9	8.5	7.5	7.5	6.2	5.0	34.8	29.4	25.0
Mean	10.4	9.5	8.9	8.4	7.4	7.0	37.6	33.8	31.8
Maximum	11.0	10.9	10.5	8.9	8.8	8.5	39.8	39.6	38.0

Up to now, we have mainly dealt with the mandible and with measurements of the lower teeth. This was of some disadvantge, since we, generally, are not so well acquainted with measurements of lower teeth. But every one of us is accustomed to take some measurements of the upper teeth, at least of the front teeth which we regard as an indicator of the size of the teeth generally. Turning to Table V, we shall, therefore, be on a much more familiar ground. This table shows at a glance minimum, mean, and maximum values of palaeolithic and modern teeth. To make the comparison more conclusive, the modern measurements are represented by figures which have been obtained from a sample of 250 children under orthodontic treatment. (The same sample as

was used for the determination of the bizygomatic breadth.) A perusal of this table will bring us to the following conclusions: (1) The maximum values of the teeth of our patients are greater than the mean values of the macrodont Krapina people. (2) The same condition exists with respect to the Mount Carmel people. But in addition to this, modern mean values surpass also their minimum values.

TABLE VI. FREQUENCY DISTRIBUTION OF UPPER CENTRAL INCISOR DIAMETERS IN 250 ORTHODONTIC PATIENTS AND COMPARISON WITH KRAPINA AND MOUNT CARMEL MEASUREMENTS

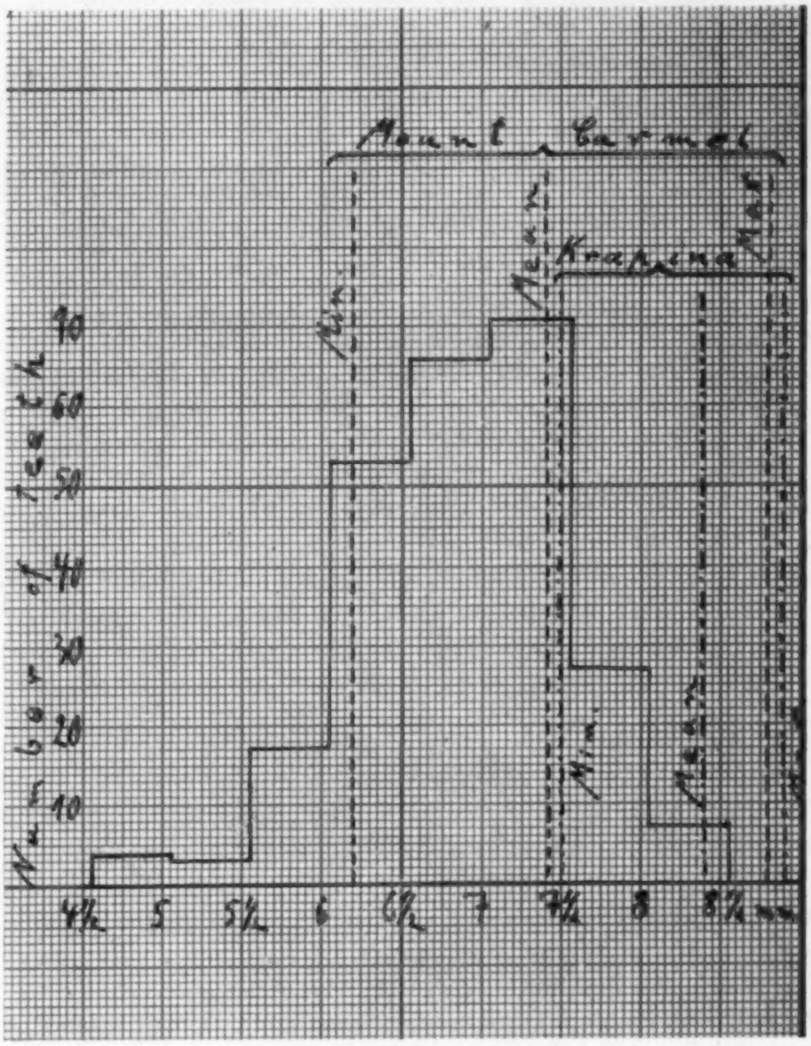


To give some idea of the frequency distribution of big teeth in the sample of 250 orthodontic patients, it may be stated that the mean value of the Mount Carmel central incisor (9.5 mm.) was reached or surpassed in 51, or 20 per cent, of the cases, that of the lateral incisor in 79, or more than 30 per cent. The mean value of the Krapina central incisor (10.4 mm.) was surpassed four times, while ten patients nearly reached it with values of 10 mm.; the lateral (8.4 mm.) was reached only once fully (8.5 mm.), but six times nearly (8.25 mm.).

I think that this detailed investigation will give our arguments a more solid foundation than the rather vague remarks we used to hear about "the

reduced size of the jaws and teeth which were not reduced to such a high extent."* There remains now no doubt about the enormous reduction which has taken place in the jaws. Only two figures need be recapitulated: The Heidelberg jaw surpasses the modern one in length by 40 per cent, in thickness by 50 to 100 per cent. There remains likewise no doubt that the teeth, too,

TABLE VII. FREQUENCY DISTRIBUTION OF UPPER LATERAL INCISOR DIAMETERS IN 250 ORTHODONTIC PATIENTS AND COMPARISON WITH KRAPINA AND MOUNT CARMEL MEASUREMENTS



have undergone a certain reduction, if we speak of "teeth" generally as expressed in averages. This reduction amounts to 5 to 10 per cent with respect to Mount Carmel and modern man, to 15 to 20 per cent for Krapina and modern man. But, as we have seen, reduction has not affected all the teeth, and the very conception of "average" implies the existence of a range of variation. This range of variation is so wide that present-day plus-variations are overlapping with palaeolithic low and mean values and, sometimes, come even near the highest values. This means in plain words that every day we may encounter teeth of Neanderthal dimensions in our patients, and thus we get disrelations on a phylogenetic basis.

Mention shall be made in this place of another possibility of disrelation in which sex may play a role, on a, at least partially, phylogenetic basis. It is

*The author himself is guilty in this respect.

a well-known fact that dimensions of the female head and face are smaller than that of the male. (This is once more demonstrated in Table II, where we find the bizygomatic breadth of the boys to be 7 mm. higher than that of the girls.) On the other hand, if there exists a sex difference in the size of modern teeth at all, it is so small as to be insignificant for practical purposes. It needed large scale investigations to discover minute difference of about 0.1 mm. (Mühlreiter, Parreidt). We know, however, that there exists a sex difference in the teeth of the primates; and recent excavations in China have revealed the interesting fact that in the *Palaeoanthropus sinicus* (Peking man), a very early ancestor of man, different sets of bigger and smaller teeth are clearly discernible which are regarded by Weidenreich as belonging to male and female specimens respectively. It is therefore conceivable that, though teeth have ceased to be secondary sex characters, nevertheless teeth which were formerly linked to one sex may now appear in the opposite sex, e.g., powerful teeth of male type in the frail frame of a girl. Thus there may even be, after all, some truth in the old primitive conception of "the father's big teeth in mothers small jaws" which has been referred to above and which has so often been denounced as "fairy tale."

Summing up the evidence, compiled in this chapter, we may state that we have found unrefutable proof for the fact that malocclusions due to disrelation can arise on a pathologic, constitutional-hereditary, or phylogenetic basis. Though these potential causes have been treated separately, it will be understood that, in the present state of knowledge, at least, it will be difficult, if not impossible, to differentiate between the exact causes in the actual cases. Moreover, it may be that two or all three causes have been participating in the formation of a case. But the fact remains that there are three different factors at work which may be—separately or jointly—responsible for the occurrence of disrelations in present man.

THE MANIFESTATIONS OF DISRELATIONS

Having dealt with the factors responsible for the formation of disrelation, we will have to look for the manifestations of these disrelations. Among the best-known symptoms—about which there is no controversy—are the difficulties connected with the eruption of the lower wisdom teeth; they range from abnormally protracted and painful eruption and partial retention to complete impaction. Under graver conditions we may even find the same symptoms in connection with the *second* lower molar. I have repeatedly observed cases where the distal parts of these teeth have remained covered by the gingiva for years, and Fig. 8 shows two cases of partial retention of second molars.

In my opinion, the ectopic eruption of cuspids, too, should in many, if not necessarily in all cases, be regarded as an expression of lack of space. Usually such cases, as reproduced in Fig. 9, are contributed to premature extraction of deciduous teeth. But Fig. 10 shows nearly identical conditions in a mixed denture where as yet no deciduous molars or cuspids have been lost. This, clearly, is a case of ectopic cuspids in its developmental stage. To round off this short survey of manifestations of disrelations, mention must be made, of course, of the familiar picture of crowded and rotated* incisors.

*There may, perhaps, be doubts as to rotations being caused by lack of space. But it can be pointed to the fact that excess of space, too, leads to rotations, though in opposite direction: the labiolingual diameter of premolars is greater than the mediodistal one, and, sometimes, in cases of excess of space, we find premolars with a rotation of 90 degrees, thus occupying more space than would normally be necessary. These rotations can be observed, at an unproportional frequency, in fossil jaws, and, today, in primitive people with spacious jaws as, f.i., in Eskimos. Occasionally, I could see them in patients where missing lateral incisors had produced a certain excess of space.

Fig. 8.—Partial retention of lower second molars.

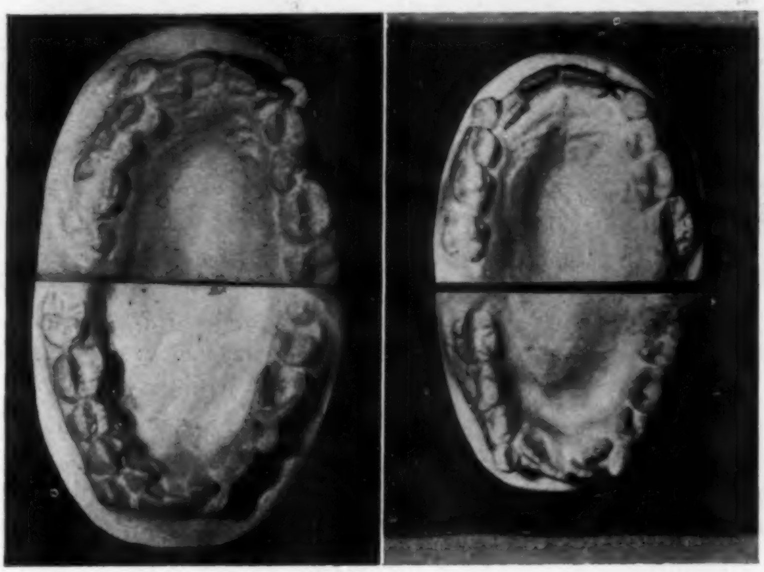


Fig. 9. Fig. 10.

Fig. 9.—Ectopic cuspids, an anomaly usually attributed to premature loss of deciduous teeth.

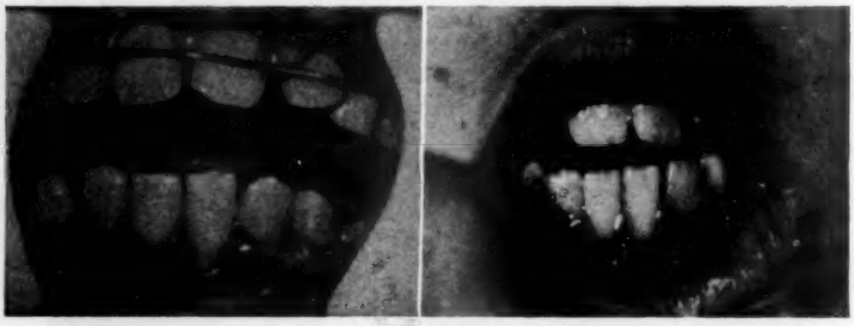
Fig. 10.—Identical conditions in mixed denture show that real cause is disrelation.

PRACTICAL CONSEQUENCES

It is these manifestations of disrelation that we are to treat in a certain percentage of our cases. It will be clear that it cannot fall within the scope of this essay, which is concerned with the theortic basis of the problem of extraction, to deal in like detail with questions of practice. But since the conception of the problem as here evolved brings about some fundamental changes in orthodontic procedure, it is nevertheless thought necessary to touch at least upon the more important items.

Anomalies of disrelation will furnish a high contingent of Angle Class 1 cases where it is generally our main task to provide for an alignment of malpositioned teeth which have not found or are not finding their normal place for lack of space. In order to procure this lacking space we have generally resorted to the panacea of "widening the arches," and in a certain number of

cases, perhaps even in the majority of cases, if the disrelations were not all too large, we may have been successful; and by "successful" in this context I do not only mean that we have succeeded in establishing a good alignment with normal occlusion. This, certainly, we can always accomplish today by means of our modern effective appliances. I mean that we have succeeded in establishing a denture which does not show the symptoms of a bimaxillary protrusion and, thus, appear "toothy." And the most important requirement is that we have succeeded in creating a denture which has stood the tests of the postretention period. For, first and foremost, the proof of a successful orthodontic treatment is in its stability. And it is here that our self-criticism comes in. That this self-criticism is not lacking is shown by the mounting number of publications about failures and relapses. Among relapses the collapse of widened arches should be one of the most frequently encountered, and this is but an indication that we have carried treatment too far, and that violated Nature has taken her vengeance.



A. *B.*

Fig. 11.—Retraction of gingiva and breakdown of lower alveolar wall in children 9 and 10 years of age.

Besides widening we have the possibility of moving teeth medially or distally in order to provide for more space. But can we, e.g., move lower incisors forward when we know the thinness and vulnerability of the labial alveolar wall? How dare we do so if children at 9 and 10 years of age come to us for treatment and present a breakdown of the alveolar wall as seen in Fig. 11? And is it, on the other hand, advisable to move molars backward and thus to trespass on the already reduced and insufficient place allotted to the third molars? In this dilemma, there is, in my opinion, only one way out: Extraction!

APPROACH TO EXTRACTION

It is, of course, never with an easy mind that we resort to extraction, and we have evolved a certain method of approach which entails precautionary measures. First of all, there is a lower age limit which is not determined by chronological but by dental age: the eruption of the first premolars. Though the waiting for this date is partially dictated by necessity, since it will generally be these teeth which have to be extracted, it has incidentally some valuable advantages.

1. At an early age, the type of a child is frequently not yet clearly discernible and, if the child remains under our observation for some years, we will be better able to appraise the inherent developmental possibilities. The same holds true of children who have undergone severe and protracted illness. Though there may be cases in which the lost development will not be recovered, there is,

on the other hand, always the possibility that such a recovery will take place. Thus, our waiting for the eruption of the premolars serves at the same time the good purpose of waiting for the unfolding of the constitutional type.

2. We will be in a better position to assess the denture we have to deal with. There exist individual variations, and it is quite possible that, though the incisors are big, the premolars will be relatively small. Thus, a kind of compensation will result, making extraction unnecessary.

3. Finally, at this stage, we will be able to verify the existence of the third molars. For it can be regarded as self-understood that in case the third molars are missing and a reduction has thus already taken place, there ceases to be any further need for extractions, and we need not fear relapses due to the pressure of developing and erupting third molars. For these reasons it should be good practice to delay treatment generally in cases where we are suspicious of a possible disrelation and the eventual need of extractions. We shall then be able to avoid those unpleasant cases which, at 6 or 7 years of age, looked like mild forms of "narrow jaws" and were immediately subjected to "early treatment." But at the age of 11 or 12 years, they revealed themselves as rather severe cases of disrelation, necessitating still further "widening" of already sufficiently or more than sufficiently expanded arches and displaying the symptoms of bimaxillary protrusion. If, then, extraction was finally resorted to, there would have remained some uneasy feeling about the years of treatment which the patient had undergone previously.

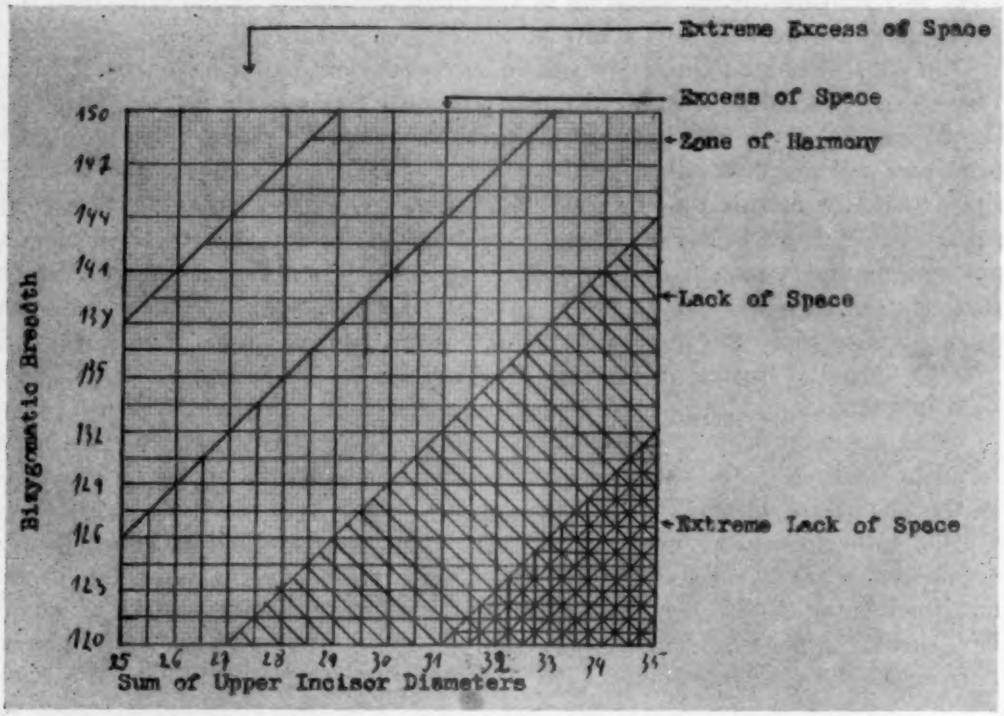
There are, however, some exceptions which make early treatment necessary even in cases of suspected disrelation. If, f.i., one or some of the upper incisors have erupted lingually or are in danger of doing so, or if the first molars are in a cross-bite position, then a partial treatment, at least, must be started immediately. But when this emergency treatment has been carried out, interruption is indicated, to wait for further developments which will allow us to come to a final decision with respect to extraction on safe foundations.

THE TECHNIQUE OF EXTRACTION

There exists up to now no safe method or system to give us a clear answer when to extract and when not to extract. On the other hand, we should be somewhat ill at ease if we had to resort to our "general impressions" or "artistic feeling" solely. In this quandary, the bizygomatic-breadth-molar-relation proves to be a valuable help. As already stated above, I could find that the bizygomatic breadth is three times the distance of the upper first molars, measured between their centers. The bizygomatic breadth measurement is taken under slight pressure, so that a deduction for the covering tissues is not necessary. It is, however, necessary to make a correction for age. According to anthropologic tables, the measurement increases at a rate of about 1½ mm. annually. If, f.i., a boy of 12 years has a bizygomatic breadth of, say, 117 mm., we have to add 8 times 1.5 mm. and to use the third of this expected bizygomatic breadth of 129 mm., that is, 43 mm. If this boy now has big teeth, and the sum of the diameters of the four upper incisors is 34 mm., then the molar distance should be 53 mm., if we employ Pont's method for arch determination. Now this boy may have an actual molar distance of 42 mm., which would be in harmony with the facial skull and the bony base, as demonstrated by the bizygomatic breadth-molar-relation, whereas according to Pont a widening of 10 mm. would be indicated. This, clearly, is a case of disrelation.

With some practice, however, is it not necessary to go the round-about way of Pont's method or any other system of arch determination which is based

TABLE VIII. DISRELATION TABLE



upon the size of the front teeth. Our investigations have shown that the average of the bizygomatic breadth is 140 mm. in boys, and 133 mm. in girls, inclusive of covering tissues as usual, while the average sum of the four upper incisors is 31.8 mm. (Pont's scale ranges from 25 to 35 mm.; this would imply an average of 30 mm.). If we now find an actual case with the bizygomatic breadth, say, 126 mm., considerably below the average, whereas the incisors diameters are 34.5 mm., near the high margin, then this comparison will also indicate a disrelation. Table VIII attempts by way of a graph to convey an impression as to how the two measurements may interact and to which symptoms the different combinations may lead. The right lower corner should contain cases in which extraction is indicated. Though this scheme, as was just said, should be regarded as a tentative one and rather as a suggestion, it might, however, in this or a similar form and after a thorough testing, become a reliable instrument for the classification of disrelations. But even in the possession of such an instrument we shall never be able to decide upon extraction automatically and on the basis of such a mechanical device only. In the same way in which different factors may combine in the creation of a disrelation, so may a combination of different reasons form our decision regarding extraction. So it has been stated above that the absence of wisdom teeth cancels an otherwise indicated extraction. The same may result from unproportionally *small* premolars. On the other hand, unproportionally *big* premolars can aggravate an originally not too severe disrelation. The condition of the teeth will have a particularly strong influence on our decision. If there are, f.i., badly decayed premolars, we may decide upon extraction more easily than we might have done otherwise.

The condition of the teeth will especially influence our choice of the teeth to be extracted. Normally, the best and generally accepted procedure is to extract the first premolars (Fig. 12). But if second premolars are decayed or

have already got extensive fillings, then these teeth should be extracted. The same holds good even of first molars, though by this way the treatment may become a prolonged one. But it is better to have this long treatment, at the end of which the patient will have a balanced denture all his own, than to insert prosthetic work so early in life.

Fig. 12.—Typical disrelation case treated with extraction of four premolars.

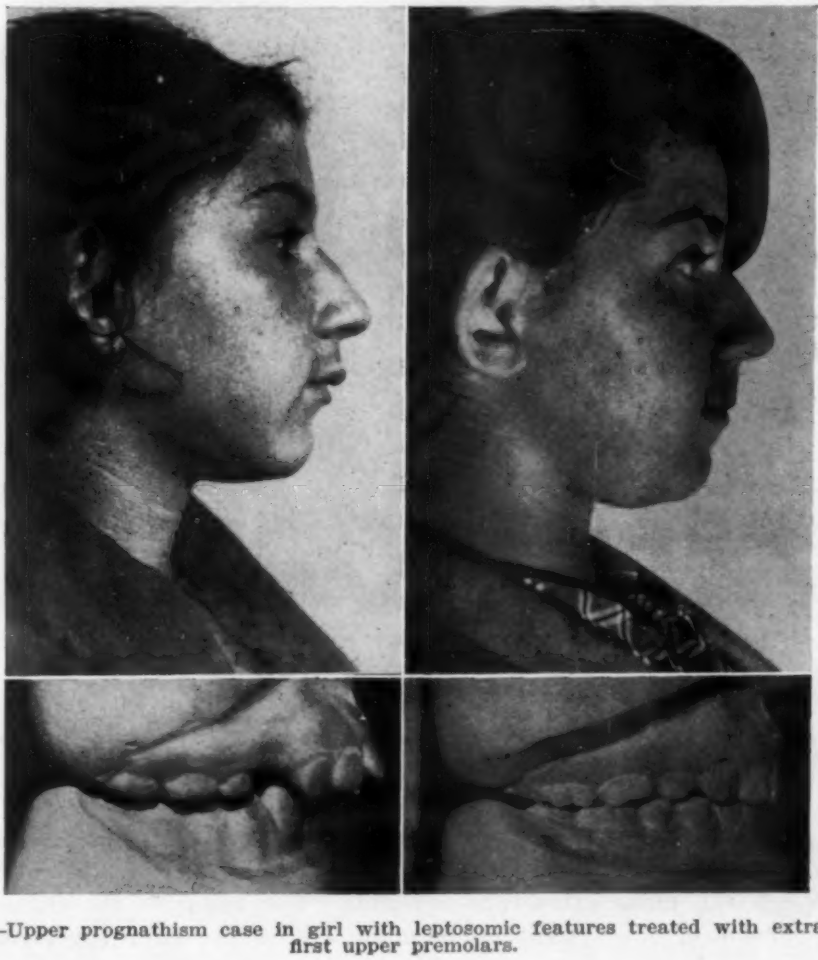


Fig. 13.—Upper prognathism case in girl with leptosomic features treated with extraction of first upper premolars.

Particularly careful considerations are necessary when asymmetric extractions are intended, as, f.i., in cases where the disrelation is not deemed so severe as to warrant systematic extractions. In the upper jaw, asymmetric extraction may cause a shifting of the median line with unfortunate esthetic results. On the other hand, such a shifting may already have taken place, and then a judicious asymmetric extraction will considerably ease the situation and allow the restoration of a normally situated median line. These esthetic considerations need not concern us to such a degree in the lower jaw. There, even the extraction of an incisor may be indicated, if the disrelation is not of such an extent as to necessitate the removal of two premolars. The extraction of an incisor which may be lingually displaced will not only do away with a complicated treatment, but it will also save us from sad disappointments; for it is generally in the lower incisor region that the greater part of relapses occurs.

Fig. 14.—Bimaxillary protrusion in a Yemenite girl treated with extraction of four premolars.

We are conscious of the fact that this rather sketchy outline of the technique of extraction does not even touch upon all the practical questions involved, but a broader treatment would not come within the scope of this essay. It seems, however, appropriate to add that the problem of extraction though *mainly* a problem of disrelation is not *entirely* so. There may be other reasons, such as peculiar constitutional patterns or progressed age, or a combination of them, which can make extraction advisable. For instance, the characteristic angular profile of the typical leptosomian will in the later teens yield to a

treatment which is combined with extractions in the upper jaw (Fig. 13). An unusual kind of bimaxillary protrusion on an atavistic or racial basis which was treated by systematic extraction of four premolars is shown in Fig. 14.

INCIDENTAL ADVANTAGES

Though extraction is essentially a cure for disrelations, it involves at the same time other incidental advantages, some of which have already been mentioned on the foregoing pages. Extractions will usually shorten a treatment and lessen the distances over which the teeth have to be moved. Both these circumstances will be of advantage with respect to root resorptions. For, though this question is not yet entirely clear, it is evident that the danger to the roots increases, the longer a treatment continues and the greater the extent of movements to which the teeth are subjected. Hardly need it be mentioned that a shortened treatment lessens the dangers of caries and is also psychologically advantageous.

Third molars will become less troublesome. A judicious and timely extraction will relieve us from the anxieties connected with the development of these teeth and will do away with the sometimes intolerably long period of observation. Since, of late, "enucleation" has become widely practiced and, thus, teeth have to be "sacrificed" anyway, it is only other teeth which are extracted.

The danger of relapses will be lessened. For teeth will not be moved away from their supporting bony structure by "widening" and will, therefore, not have to revert to statically sounder positions after the end of the treatment and the removal of the retention appliances.

Finally, esthetic results will be better if the denture is reduced and brought into proportion with small and narrow faces; the appearance of a "toothy" mouth will be avoided.

SUMMARY

To conclude this essay, it will be stated once more that the problem of extraction is essentially a problem of disrelation. This disrelation is latent in recent man on a phylogenetic basis since the teeth are not sufficiently reduced and thus out of proportion to the much reduced jaws. This disrelation becomes still more accentuated if occurring in individuals of certain constitutional pattern.

On the strength of these facts, we should adopt a less tooth-centered point of view when appraising our patients and their anomalies. We should speak less of "narrow jaws," of "too small jaws," and of the "necessity of widening underdeveloped jaws." For we have seen that jaws are reduced, that a small or narrow palate, generally, corresponds to the special type of an individual and that, if we want to speak in the case of disrelations of a "fault" at all, it is not the "fault" of the jaws but that of the teeth which are out of proportion to the general habitus of the patients.

Since we cannot change the habitus of the patient, we have only the other possibility left: to adapt the denture to the patient by reduction. We have seen that Nature herself has chosen this path, be it by reducing the number of the teeth, be it by reducing their average size. But Nature has not yet succeeded in creating a satisfactory balance.

On the contrary, if we look at the problem from an evolutional point of view, we shall realize that recent man's mouth is a battleground where evolution just now is waging a fierce campaign. At the head of this article, a sentence is quoted which Galton wrote more than half a century ago: that man

from observation of the past should infer the course evolution is bound to pursue, and that he might devote his modicum of power, intelligence, and kindly feeling to render future progress less slow and painful. With respect to the problem we have discussed, we cannot, in the present state of our knowledge at least, accelerate the evolutional process. But, I think, we can make it less painful by anticipating and executing Nature's own intentions: reduction of the denture.

REFERENCES

Abel, O.: Untersuchungen über die getrennte Vererbung der Kiefergrösse und Zahngrösse bei Mischlingen von Buschmännern, Hottentotten und Negern, Akad. Anzeiger, Wien, 1931.
Angle, E. H.: Malocclusion of the Teeth, Philadelphia, 1907, S. S. White Dental Mfg. Co.
Berger, H.: Untersuchungen über das Verhältnis der Schädelbreite zur Zahnbogenbreite, Korrespondenzbl. f. Zahnärzte, 1927.
Berger, H.: Constitution, Heredity and Orthodontia, Am. J. Orthodontics and Oral Surg. 24: 136, 1938.
Berger, H.: Constitutional Aspects of Orthodontic Problems, Am. J. Orthodontics and Oral Surg. 26: 566, 1940.
Bond: See Gates.
Boule, M.: Fossil Men, Edinburgh, 1923.
Brin: See Gates.
Chapman, H.: A Note on Extraction in Orthodontic Cases, Int. J. Orthodontia 20: 561, 1934.
Davenport and Steggerda: Race Crossing in Jamaica, Washington, 1929.
De Jonge-Cohen: Maximal-, Minimal- und Mittelwerte der mesio-distalen Dimensionen der Zähne des menschlichen Gebisses, Oesterr. Ztschr. f. Stomatol. 1918.
Fischer, E.: Die Rehoboter Bastards, Jena, 1913.
Fleming: See Gates.
Galton, F.: See Pearson.
Gates, R. R.: Heredity in Man, London, 1929.
Gorjanovic-Kramberger: Der diluviale Mensch von Krapina in Kroatien, Wiesbaden, 1906.
Hellman, Milo: Editorial, Am. J. Orthodontics and Oral Surg. 29: 610, 1943.
Hrdlička, A.: The Skeletal Remains of Early Man, Washington, 1930.
Hrdlička, A.: Normal Variation of Teeth and Jaws, Int. J. Orthodontia 21: 1099, 1935.
Jackson, A. F.: Facts, Fictions and Fallacies in Orthodontia, Int. J. Orthodontia 23: 1073, 1937.
Johnson, A. LeRoy: Biologic Principles in Malocclusion, Int. J. Orthodontia 20: 4, 1934.
Johnson, A. LeRoy: Constitutional Factor in Skull Form and Dental Occlusion, Am. J. Orthodontics and Oral Surg. 26: 627, 1940.
Keith, A.: The Antiquity of Man, London, 1925.
Kretschmer, E.: Physique and Character, London, 1925.
Martin, R.: Lehrbuch der Anthropologie, Jena, 1928.
McCown and Keith: The Stoneage of Mount Carmel, Oxford, 1939.
Mershon, J. V.: Failures, Int. J. Orthodontia 22: 338, 1936.
Mershon, J. V.: The Significance of the Angle School, Am. J. Orthodontics and Oral Surg. 25: 971, 1939.
Mühlreiter, E.: Anatomie des menschlichen Gebisses, Leipzig, 1928.
Parreidt, J.: Die Breite der oberen zentralen Schneidezähne beim männlichen und weiblichen Geschlecht, Deutsche Monatschr. f. Zahnh. 2: 1884.
Pearson: Life, Letters and Labours of Francis Galton, Cambridge.
Schoetensack: Der Unterkiefer des Homo Heidelbergensis, Leipzig, 1908.
Stockard: The Genetic and Endocrine Basis for Differences in Form and Behavior, Philadelphia, 1942.
Strang, R. H. W.: The Analysis of a Complicated Case, Am. J. Orthodontics and Oral Surg. 25: 330, 1939.
Taylor, A. T.: Crumbs From the Orthodontic Table, Int. J. Orthodontia 23: 1102, 1937.
Weidenreich, F.: The Dentition of Sinanthropus Pekinensis, Palaeon. Sin., Series D, Peking, 1937.

Editorial

Frederick Lester Stanton
1873-1945

FREDERICK LESTER STANTON was born in the town of Norwich, Connecticut, on March 9, 1873. He was a direct descendent of John Alden and Priscilla Mullins, immortalized by Longfellow. Crippled at birth, much of his early childhood was given to the effort of correcting a clubfoot deformity, and by the time he had reached the age of 6 years he had had two or three operations. Discouraged by the results, his parents, Caroline and George Stanton, sought the services of a prominent New York surgeon, and, so that medical and surgical treatment might continue uninterrupted for their son, moved their home to Brooklyn, New York.

Young Stanton suffered himself to be operated upon several times more before any evidence toward correction was obtained. Growing into boyhood, he set out with grim determination to erase the physical handicaps that might result from the remaining partial deformity. Interesting himself in any type of physical play that would give the muscles of his feet and legs greater activity, he turned to tennis and, as is the case with many of firm resolution, he later overcame much of his handicap and played the game with greater than average skill.

At the completion of his elementary school education, young Stanton attended Boys' High School, Brooklyn. He retained his interest in that secondary school all his life. Developing an early interest in dentistry, he began his dental education under the guidance of his preceptor, Dr. W. G. Stewart. He matriculated at the New York College of Dentistry in 1891, sponsored by Dr. Stewart, and finished his course of study the following year. However, not having attained his twenty-first birthday, he had to stand by and watch his classmates take part in the twenty-sixth annual commencement of his alma mater, the third oldest dental college in America, without him, and to wait impatiently another year before he was permitted to receive his diploma and be admitted into his chosen profession.

Upon graduation, he opened his dental offices on West Thirty-Fourth Street, New York City. Dr. Stanton, however, was not to remain long in general practice, for, upon the turn of the century, his interests had already been drawn to the young and rapidly developing "science" devoted to the correction of irregular teeth. That he should choose as his lifework a specialized field within his own profession dealing with a physical handicap in the child was not mere chance. His early childhood had left a profound impression upon Dr. Stanton, and the strong humanitarian desire to serve in the interest of the growing child

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This biographical review of the life and professional career of Dr. Frederick L. Stanton was prepared by Dr. Samuel Hemley, Professor of Orthodontics, New York University College of Dentistry.

Dr. Hemley was the immediate successor to Dr. Stanton's chair of orthodontics in that institution and long his loyal friend.

It is affectionately dedicated to his family, his friends, and to the history of scientific progress in orthodontics to which he so ably contributed.

was born of his experience in overcoming his own physical handicaps. So strong did his interest in orthodontics become that, in 1905, he decided to give up his general practice and journey to St. Louis to enroll in the Angle School of Orthodontia. Following the completion of his course of study with Angle, he returned to New York to devote himself to the exclusive practice of orthodontics. In the following year Dr. Stanton helped organize the Alumni Society of the Angle School of Orthodontia, served on the Executive Committee, and became president of the Society in 1907. His interests in orthodontic problems deepened and he began to contribute to the literature early in his career. He was responsible in part for the appearance in 1907 of *The American Orthodontist,* the first specialized dental publication, and in the introductory issue was the first of his many orthodontic contributions, "Distal Occlusion of the Deciduous Teeth." Another paper entitled "Orthodontia Diagnosis" appeared in the *Journal of the Allied Dental Societies* that same year.

In 1908 when Dr. Angle decided to retire from active practice in St. Louis in order to devote his entire attention to the school, Stanton not only prevailed upon Angle to come east to hold the school session that year in New York City, but acted as secretary to the school in 1908 and 1909 as well. He also taught rhinology at the Angle School during these two years. In 1910 his third article, "The Teeth in Respiration," appeared in the *Dental Digest.* Stanton gathered about him all those who were as eager as he to interchange orthodontic thoughts, ideas, and experiences. They met at his office, became a study group, and in order to promote orthodontic thought and to further interest in the young specialty, formed the Eastern Association of Graduates of the Angle School of Orthodontia.

In 1911 Frederick L. Stanton married Virginia Boardman Randell, daughter of Rufus and Caroline Randell, at Greenwich, Connecticut.

That he was able to dispose of a controversial issue with dramatic thoroughness was well illustrated at a meeting of the American Laryngological, Rhinological and Otological Society in Philadelphia in 1912. Orthodontic treatment at that time was ofttimes rapid, sometimes drastic and excessive. It was thought that rapid maxillary expansion opened the maxillary sutures, and at times an effort was made to gain that objective with an eye to obtaining greater nasal width. Dr. Stanton had prepared in advance the wet specimen of a head upon which powerful jackscrews were attached to the maxillary sutures and at the meeting endeavored to spread the suture without success, thus disposing of this question in orthodontic treatment.

Ever interested in the plight of underprivileged children, his tireless efforts in their behalf were finally rewarded when, in 1913, he interested the Manhattan Eye, Ear, Nose and Throat Hospital in founding a clinic for orthodontic treatment. This was to be the first orthodontic clinic established in an institution.

In the following years Stanton delved more and more into the etiology and treatment of malocclusion. In 1914 there appeared in the *British Dental Journal* his article on "Heredity" and its relation to teeth, and, in the *Dental Cosmos,* "Mendelism and Its Bearing on Some Dental Problems." At this time, too, he conceived the idea that the rearrangement of malposed teeth was basically a problem in engineering and sought to place the rationale of orthodontic treatment with mathematical exactness under the guidance of engineering principles. Dr. Stanton, however, needed the collaboration of an engineer. He succeeded in interesting Rudolph Hanau, and together they designed a projecting device for surveying the human dentition. The results of their joint effort were published

in 1915 in an article entitled "An Instrument for Surveying and Mapping the Denture."

Hanau had had no contact with dentistry prior to his association with Stanton. His interest in dentistry and in the problems of the profession were stimulated and developed as a result of his contact with Dr. Stanton and therefore Hanau's contributions to dentistry may be attributed to Stanton's influence.

While Stanton and Hanau were working together, they had designed the projecting device for surveying, but the problem of the relationship of the map of the anticipated normal occlusion to the map of malocclusion was never completed. It was with Gilbert D. Fish, another engineer, that he was able to perfect the concept of the relationship of the two maps with the theory of least squares, using the perfected occlusograph which was a chain of links representing the mesiodistal diameters of the teeth.

(Blackstone Studios New York)

Frederick Lester Stanton

By the theory of least squares, Stanton was able to compute the least possible sum total of tooth movements necessary in treatment to change the positions of all the teeth from the existing malocclusion to a corrected occlusion. He computed mathematically an imaginary point called the centroid for each map, and there was also computed an axis of symmetry for the teeth in malocclusion and for the corrected occlusion. By superposing the centroids of each map and their axes of symmetry, the movements necessary to change the teeth from malocclusion to the corrected occlusion were indicated. He published the results of the application of these principles to orthodontic treatment in a series of papers. In 1916 there appeared "Dental Surveying and Arch Predetermination—New Evidence in Favor of Early Treatment," and "Orthodontic Engineering"; in 1917, "Science Versus Empiricism," and "Scientific Versus Unscientific Orthodontia." In 1918 Dr. Stanton published "Movement of Teeth Predetermined by Engineering Instruments" and "Engineering Principles Applied to Dentistry."

In his application of the theory of least squares in the rationale of orthodontic treatment, Stanton was among the first to recognize the fact that the maxillary first molars were not constant in their relationship to the rest of the cranial structures. While he never used this language specifically in his plan of treatment, the centroid was used as a constant and the maxillary first molars were moved.

In spite of his fealty to the Eastern Association of Graduates of the Angle School of Orthodontia, Dr. Stanton was a charter member of the New York Society of Orthodontists during 1921-1922.

Realizing the scope which the science and practice of orthodontics had reached by that time, he was convinced that an organization was necessary to which all qualified specialists along the eastern Atlantic seaboard from Canada to the District of Columbia would be eligible for membership.

During the organization meetings his counsel was sound and his opinion or advice settled many discussions. Among other things, he recommended the formation of an Advisory Committee whose function was to refer all debatable problems and also to stay in contact with all correlated sciences which were either associated with, or would have a bearing on, orthodontic progress.

Dr. Stanton served as Vice President of the Society and was later made an Honorary Member.

Another of Dr. Stanton's contributions to orthodontics resulted from his measurement of teeth in the use of the occlusograph which was locked between the upper and lower first molars. It was not uncommon to find that there was more tooth structure in the lower jaw than there was in the upper jaw and that, at times, harmonious curves could not be established which would accommodate the perfect alignment of both the upper and lower teeth. In order to achieve a satisfactory plan of treatment, the links which represented the upper teeth were frequently broken and slight spaces created in the anterior maxillary region to permit the proper alignment of the lower anterior teeth. While this plan of treatment was advocated, there was no assurance that the spaces between the upper anterior teeth would not close and a crowding of the lower anterior teeth result.

Another one of his contributions to orthodontics was the recognition of the fact that the general arch form in malocclusion served as a guide for the arch form for the corrected case. It was always taught by him that the links of the occlusograph should be set up to follow closely the pattern of the malocclusion. In establishing the form of normal occlusion Stanton emphasized the necessity for the elimination of rotations, the establishment of the normal axial inclination of the teeth, and the attainment of a normal occlusal plane. His work showed the variation in position of the maxillary cuspid in its relation to Simon's orbital plane in normal occlusion. He also showed the fallacy of arch predetermination as computed by Pont's index.

Although Dr. Stanton devoted his life to orthodontics, his interests were varied. He was a master at bridge and took a keen interest in the development of color photography. He took an active part in the affairs of the Alumni Association of his alma mater, the New York College of Dentistry. He did not, however, hold office in the alumni association until 1923 when he became its secretary and in 1925 its president. It was in the latter year that the old dental college was taken over by New York University. This dental college, the third oldest dental school in America in its development, had paralleled the development of dentistry. Through Stanton's efforts a merger was consummated be-

tween the alumni association of the old school and the New York University Alumni Federation. It was with great pride, on July 24, 1926, that he wrote to the members of the first graduating class of the New York University College of Dentistry welcoming them into the New York University Dental Alumni Association. In 1927 the dental alumni association elected him as their first representative to the Alumni Federation of New York University. With the loss of the identity of the New York College of Dentistry after being absorbed by New York University, the faculty and the dental course of study were reorganized. Holmes C. Jackson, the first dean of the New York University College of Dentistry, appointed Dr. Stanton professor of the Department of Preventive Dentistry and Occlusion. As the head of this department he was the first to introduce the teaching of human occlusion as a basic subject into the dental curriculum. Orthographic denture maps, in three dimensions, were used to teach the form and size of the "milling machine."

In 1929, some three years later, Dr. Stanton was offered the professorship in orthodontia. Accepting the added burden, he retained the chair until 1933. His interests, however, had turned primarily to the prevention of dental disease. In 1930 he organized a division of child research, a project planned to cover a span of fourteen years, to study the growth and development of the human dentition. In 1932 Stanton decided to devote himself entirely to this project and retired from private practice. It was during this year that New York University accorded him the Alumni Meritorius Award. He was also a faculty member of the honorary society Omicron Kappa Upsilon.

Until his retirement in 1937, Stanton devoted himself entirely to the study of growth and development of the human dentition. In these latter years, in collaboration with Marcus Goldstein, an anthropologist, he published a series of articles covering the results of his research.

Following retirement, he maintained his interest in this field by keenly following the literature and attending professional meetings.

After a brief illness, he quietly passed away on Jan. 1, 1945, and was laid to rest by a host of loyal friends.

He is survived by his widow, Virginia R. Stanton, his son, John Alden Stanton, and his daughter, Carolin Stanton Rhoades.

The following is a complete list of the articles he wrote:

Am. Orthodontist **1**: 17-18, 1907-08.
Orthodontic Diagnosis: J. Allied Den. Soc. **2**: 154-160, 1907.
Distal Occlusion of the Deciduous Teeth: Am. Orthodontist **1**: 44-48, 1907-08.
President's Address: Den. Brief **13**: 416-420, 1908.
The Teeth in Respiration: (re Mouth Breathing and Irregularities) D. Digest **16**: 211-218, 1910.
Heredity (re Teeth): Brit. D. J. **35**: 1293-1296, 1914.
Mendelism and Its Bearing on Some Dental Problems: Dental Cosmos **56**: 106, 1914.
(and Hanau, Rudolph L.): An Instrument for Surveying and Mapping the Denture: Panama-Pacific D. Cong. **2**: 48-76, 1915.
Dental Surveying and Arch Predetermination. New Evidence in Favor of Early Treatment: Oral Health **6**: 183-191, 1916.
Orthodontic Engineering: INT. J. ORTHODONTIA **2**: 235-245, 1916.
Science versus Empiricism in Orthodontia: Brit. D. J. **60**: 218-219, 535-537, 1917.
Report of a Case of Distal Occlusion, Showing Results of One Treatment: Dental Cosmos **59**: 811-813, 1917.
A Trip to California: D. Digest **23**: 364-369, 1917.
Scientific versus Unscientific Orthodontia: INT. J. ORTHODONTIA **3**: 308-309, 1917.
Movement of Teeth Predetermined by Engineering Instruments: Dental Cosmos **60**: 39-45, 1918.
Engineering Principles Applied to Dentistry: Dental Cosmos **60**: 336-338, 1918.
A Consideration of Normal and Abnormal Dentures as a Problem of Three Dimensional Spaces and Its Bearing on Orthodontic Classification and Terminology: INT. J. ORTHODONTIA **8**: 185-204, 1922.

Arch. Predetermination and a Method of Relating the Predetermined to the Malocclusion, to Show the Minimum Tooth Movement: INT. J. ORTHODONTIA 8: 757-775, 1922.
On the Application of Mathematics to Orthodontia: D. Record 44: 488-489, 1924; INT. J. ORTHODONTIA 11: 618, 1925.
Diagnostic Methods of Malocclusion and Simple Methods of Treatment: D. Digest 31: 819-824, 1925.
Class I (Neutroclusion) Impacted Maxillary Canine With Forward Drift of Maxillary Right Molars and Premolars, Simulating a Class II Subdivision Case: Inter. Ortho. Cong. (First) Trans., 1926, pp. 587-601.
Engineering in Orthodontic Diagnosis: Inter. Den. Cong. (Seventh) Trans., pp. 1286-1290.
A Critique of Simon's Diagnostic Methods: Am. Soc. Ortho. Trans. 1927, pp. 159-186.
Preventive Orthodontia: D. Digest 33: 155-157, 1927.
On Unilateral Distal Occlusion (Treatment): Am. Soc. Ortho. Trans., 1928, pp. 253-258.
In Identical Twins (re Hereditary Irregularity of Teeth): INT. J. ORTHODONTIA 14: 228-232, 1928.
Reconstructing the Heidelberg Jaw: Dental Cosmos 70: 927-929, 1928.
(and Fish, G. D., and Ashley-Montagu, M. F.): Description of Three Instruments for Use in Orthodontic and Cephalometric Investigations, With Some Remarks on Map Construction: J. Dent. Research 11: 885-902, 1931.
Results Obtained by the Use of a Willett Space Retainer (Case Report): New York J. Den. 3: 289-290, 1933.
A Technic for Measuring the Relative Movements of Teeth Due to the Growth of the Jaws or the Premature Loss of Deciduous Teeth: INT. J. ORTHODONTIA 19: 1229-1237, 1933.
Some Suggestions for the Improvement of Orthodontic Practice: INT. J. ORTHODONTIA 21: 29-39, 1935.
(and Goldstein, Marcus S.): Changes in Dimensions and Form of the Dental Arches With Age: INT. J. ORTHODONTIA 21: 357-380, 1935.
(and Goldstein, Marcus S.): A Quantitative Study of Dental Occlusion Between Two and Ten Years (Abnormal; Normal): Dental Cosmos 78: 130-140, 1936.
(and Goldstein, Marcus S.): Various Types of Occlusion and Amounts of Overbite in Normal and Abnormal Occlusion Between Two and Twelve Years: INT. J. ORTHODONTIA 22: 549-569, 1936.
(and Goldstein, Marcus S.): Additional Data on Types of Occlusion in a Sample of the American Population: J. Am. Dent. A. & Dental Cosmos 24: 1327-1335, 1937.
(and Goldstein, Marcus S.): Facial Growth in Relation to Dental Occlusion, INT. J. ORTHODONTIA 23: 859-892, 1937.

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Department of Orthodontic Abstracts and Reviews

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Annual Review of Physiology: James Murry Luck, Editor, Stanford University, and Victor E. Hall, Associate Editor, Stanford University. Volume VII. Price $5. Stanford University, Calif., American Physiological Society and Annual Reviews Inc., 1945.

The present volume is the largest of the reviews published to date. Included in the contents are chapters on the "Physiological Aspects of Genetics," "Developmental Physiology," "Muscle," "Metabolic Functions of the Endocrine System," "Exercise and Physiological Psychology," which will prove of especial interest to dentists and orthodontists. The chapter on "Muscle" includes a review of sketeletal muscles, including structural and mechanical properties.

With regard to salivary glands, it was found that dehydration was directly responsible for the decrease of secretion of saliva. In work on swallowing, it was found that the epiglottis does not remain upright during swallowing but turns over to act both as a chute for the food and a guard for the larynx. A new reflex involving swallowing has been described; an involuntary swallowing movement occurs when a person, with eyes closed, suddenly immerses his head in cold water. Swallowing of amniotic fluid by the fetal monkey in utero increases in frequency as gestation progresses. Three types of muscular activity of the human esophagus were observed roentgenologically. A primary wave begins at the pharynx, a secondary wave begins in the region of the aortic arch, and a tertiary or localized contraction may occur which is not peristaltic in nature. The book has an extensive bibliography and a detailed index.

A Text Book of Oral Pathology: By Thomas J. Hill, D.D.S., Professor of Clinical Oral Pathology and Therapeutics, Western Reserve University, Cleveland, Ohio. Third edition, thoroughly revised. Illustrated with 332 engravings. Pp. 407. Price $6.50. Philadelphia, Lea & Febiger, 1945.

The revised third edition of this book constitutes an organized and comprehensive guide to the study of oral disease, and is a handy reference book for dentists and dental teachers. Concisely written, the book presents in a clear, complete, and detailed manner the pathologic lesions of the oral cavity and their significance in the practice of dentistry.

An effort is made to point out the close relationship between local oral conditions and the health of the body as a whole. Discussions over unsettled questions are avoided throughout the book, except in the chapter dealing with dental caries. References and bibliography are up to date. The chapters on hypoplasia of enamel and dentine and the clinical and pathologic changes in tooth structure associated with these conditions, as well as etiological factors involved, are presented in a most complete manner. The chapter on caries constitutes a complete review of the subject, on which the author is a recognized authority.

The bases for rational treatment are here established for this division of oral pathology which, more than any other field, needs clarification for the average dentist.

The chapter on "Malocclusion of the Teeth and Dentofacial Abnormalities," written by B. E. Lischer, gives a short outline of the fundamental principles of this specialized field of dentistry.

"Tumors of the Mouth," contributed by Carl E. Waldron, is a valuable and interesting addition to the text.

This book will be welcomed by all dentists, as the author has more than adequately treated, in a straightforward way, a large variety of subjects which make up an everready guide to the study of oral pathology.

Carlos Giro, D.D.S.

Dental Chronology. A Record of the More Important Historic Events in the Evolution of Dentistry: By Hermann Prinz, A.M., D.D.S., M.D., Sc.D., De. Med. Dent., Emeritus Professor of Pharmacology and Lecturer, The Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania. Octavo, Pp. 189, Illustrated with 97 engravings. Price $3.00. Philadelphia, Lea & Febiger, 1945.

This volume is intended as a supplement to the usual course in dental history. It contains a great deal more than that, however, since it presents in chronological order an account of the various persons and events concerned not only with dental science but also with the related fields of medicine, surgery, and pharmacology. We agree with the author when he says that "the art of dentistry requires an intimate understanding of its numerous mechanical devices, as employed in the routine of a busy practice: therefore, a clear comprehension of their proper application is essential to obtain the desired results."

Prinz shows a wide knowledge of dentistry in ancient times. The photographic reproductions alone are worth the price of the book. Prinz has collected photographs of paintings on the dentist and dentistry in ancient and medieval times, second to none. Full evidence to this collection has been included here.

Among the many interesting facts presented is the statement that Saint Apollonia is the patron saint of people suffering with toothache and not the patron saint of the dentist, as is so frequently stated. Saint Cosmas, whose name is seldom heard in dentistry, is actually the patron saint of the dental operator. Among the important data presented on the various phases of dentistry is a chronology of events in the discovery and development of local and general anesthesia. The book is an interesting and useful addition to dental literature.

News and Notes

Second Annual Seminar for the Study and Practice of Dental Medicine

The Second Annual Seminar for the Study and Practice of Dental Medicine was held in Palm Springs, California, from Oct. 7 to 12, 1945. Participants in the Seminar were members of the dental profession, medical profession, and research workers in the biologic sciences. The primary aim of the meeting was to study the prevention and eradication of diseases of the mouth and related areas. Among the subjects scheduled for presentation and discussion were: recent advances in nutrition, endocrinology, physiology of body fluids, psychosomatic medicine and dentistry, and pathology of teeth, osseous structures, and blood. Attendance at the conference was limited in number because of the seminar character of the meeting.

The Seminars are approved and sponsored by the Divisions of Educational Courses of the Southern California State Dental Association, the Oregon State Dental Association, and the British Columbia Dental Association.

The New York Society of Orthodontists' November Meeting Canceled

After much work on the part of the Chairman of the Executive Committee in preparing a program for a November meeting of The New York Society of Orthodontists, we now find that the Waldorf cannot make any reservations for our membership. Upon inquiring of the Hotel Association of New York, we furthermore can get no definite assurance that accommodations can be obtained in other hotels in New York during the time we had set for our November meeting.

The Advisory Committee therefore feel, in fairness to the entire membership, that we should postpone our November meeting with the hope that by March conditions will have returned to normalcy to the extent of allowing us to hold our Annual Meeting.

We are immediately taking steps in an endeavor to assure ourselves of a place with proper accommodations for a meeting next March and of this we will keep you advised.

Raymond L. Webster, President.

Surgeon General Announces New Officer Release Policy

A revised point system program which will return 13,000 physicians, 25,000 nurses, 3,500 dentists and an undetermined number of other Medical Department officers to civilian life by January, 1946, was announced Sept. 14, 1945, by Major General Norman T. Kirk, the Surgeon General.

Under the plan those Medical and Dental Corps officers who have 80 points, are 48 years of age, or have been in the Army since before Pearl Harbor, will be released as surplus officers unless they are specialists in eye, ear, nose, and throat work, plastic surgery, orthopedic surgery, neuropsychiatry, or are laboratory technicians. These specialists will be released if they were called to active duty prior to Jan. 1, 1941.

This is a drastic lowering of points below the previous plan which was based on the adjusted service score of 100 for nonscarce Medical Corps officers and 120 for those in scarce categories.

A similar drastic reduction was made in the point score for nurses, who are now eligible for discharge if their rating is 35 or more, or if they are 35 years old. In addition all married nurses and those with children under 14 years are eligible for immediate separation. Physical therapists and dietitians are eligible under the same conditions if their point score is 40 or more, or if they are 40 years old.

Veterinary Corps officers will be eligible for discharge if they have a point score of 80 or more, if they are 42 years old, or if they joined the Army prior to Jan. 1, 1941.

Medical Administrative and Sanitary Corps officers with point scores of 70 or more, who are 42 years of age or have been in servive since before Pearl Harbor will be released as surplus.

General Kirk added that in some cases essential officers may be retained by military necessity until replacements are shifted to their positions but none will be held in service after Dec. 15, 1945, without their consent.

Every effort will be made to release these officers at the earliest possible moment consistent with military needs, General Kirk added.

It is also anticipated that, on the basis of an army of 2,500,000 men, a total of 30,000 doctors, 40,000 nurses and 10,000 dentists will be released by July, 1946, and if the armies of occupation and troops in the United States are concentrated at large posts these figures will be exceeded. These figures represent approximately 70 per cent of the peak strengths at V-E Day of those corps.

Notes of Interest

Capt. Byron W. Cordes, Army Dental Corps, announces the reopening of his office at 903 Missouri Theatre Building, St. Louis 3, Missouri. Telephone, JEfferson 8170. Practice limited to orthodontics.

Dr. Ernest E. Palmatary announces the resumption of his practice of orthodontics, after having retired from the Army Dental Corps, at 116 West 47th Street, Country Club Plaza, Kansas City 2, Missouri. Telephone, LOgan 7335.

OFFICERS OF ORTHODONTIC SOCIETIES*

American Association of Orthodontists

President, Archie B. Brusse - - - - - - - - - - 1558 Humboldt St., Denver, Colo.
President-Elect, Earl G. Jones - - - - - - - - - - 185 East State St., Columbus, Ohio
Vice-President, Will G. Sheffer - - - - - - - - Medico-Dental Bldg., San Jose, Calif.
Secretary-Treasurer, Max E. Ernst - - - 1250 Lowry Medical Arts Bldg., St. Paul, Minn.

Central Section of the American Association of Orthodontists

President, Arthur C. Rohde - - - - - - - - 324 E. Washington Ave., Milwaukee, Wis.
Secretary-Treasurer, L. B. Higley - - - - - - - - - 705 S. Summit St., Iowa City, Iowa

Great Lakes Society of Orthodontists

President, Willard A. Gray - - - - - - - - - - Medical Arts Bldg., Rochester, N. Y.
Secretary-Treasurer, C. Edward Martinek - - - - - - 661 Fisher Bldg., Detroit, Mich.

New York Society of Orthodontists

President, Raymond L. Webster - - - - - - - - - 155 Angell St., Providence, R. I.
Secretary-Treasurer, Norman L. Hillyer - - - - - - Professional Bldg., Hempstead, N. Y.

Pacific Coast Society of Orthodontists

President, J. Camp Dean - - - - - - - - - - - - 1624 Franklin St., Oakland, Calif.
Secretary-Treasurer, Earl F. Lussier - - - - - - - 450 Sutter St., San Francisco, Calif.

Rocky Mountain Society of Orthodontists

President, Henry F. Hoffman - - - - - - - - - 700 Majestic Bldg., Denver, Colo.
Secretary-Treasurer, George H. Siersma - - - - - - 1232 Republic Bldg., Denver, Colo.

Southern Society of Orthodontists

President, Amos S. Bumgardner - - - - - - - - Professional Bldg., Charlotte, N. C.
Secretary-Treasurer, Leland T. Daniel - - - - - - 407-8 Exchange Bldg., Orlando, Fla.

Southwestern Society of Orthodontists

President, Harry Sorrels - - - - - - - - - Medical Arts Bldg., Oklahoma City, Okla.
Secretary-Treasurer, James O. Bailey - - - - - - Hamilton Bldg., Wichita Falls, Texas

American Board of Orthodontics

President, Frederic T. Murlless, Jr. - - - - - - - - 43 Farmington Ave., Hartford, Conn.
Vice-President, Joseph D. Eby - - - - - - - - - - 121 E. 60th St., New York, N. Y.
Secretary, Bernard G. deVries - - - - - - - - Medical Arts Bldg., Minneapolis, Minn.
Treasurer, Oliver W. White - - - - - - - - - 213 David Whitney Bldg., Detroit, Mich.
James D. McCoy - - - - - - - - - 3839 Wilshire Blvd., Los Angeles, Calif.
Claude R. Wood - - - - - - - - - - - Medical Arts Bldg., Knoxville, Tenn.
James A. Burrill - - - - - - - - - - - 25 E. Washington St., Chicago, Ill.

Harvard Society of Orthodontists

President, Francis J. Martin - - - - - - - - - - - - 1074 Centre St., Newton, Mass.
Secretary-Treasurer, Edward I. Silver - - - - - - - - - 80 Boylston St., Boston, Mass.

Washington-Baltimore Society of Orthodontists

President, Francis M. Murray - - - - - - 1029 Vermont Ave., N.W., Washington, D. C.
Secretary-Treasurer, William Kress - - - - - - - Medical Arts Bldg., Baltimore, Md.

*The Journal will make changes or additions to the above list when notified by the secretary-treasurer of the various societies. In the event societies desire more complete publication of the names of officers, this will be done upon receipt of the names from the secretary-treasurer.

St. Louis Society of Orthodontists

President, Virgil A. Kimmey - - - - - - - 3722 Washington Ave., St. Louis 8, Mo.
Vice-President, Leo M. Shanley - - - - - - - 7800 Maryland Ave., Clayton 5, Mo.
Secretary-Treasurer, Everett W. Bedell - - - - - 1504 S. Grand Blvd., St. Louis 4, Mo.

Philadelphia Society of Orthodontists

President, John V. Mershon - - - - - - - - - 1520 Spruce St., Philadelphia 2, Pa.
Vice-President, Frederick R. Stathers - - - - - - - 269 S. 19th St., Philadelphia, Pa.
Secretary-Treasurer, Augustus L. Wright - - - - - 255 S. 17th St., Philadelphia 3, Pa.

Foreign Societies*

British Society for the Study of Orthodontics

President, S. A. Riddett - - - - - - - - - - - 42 Harley St., London, W. 1, England
Secretary, R. Cutler - - - - - - - - - - 8 Lower Sloane St., London, S.W. 1, England
Treasurer, Harold Chapman - - - - - - - 6 Upper Wimpole St., London, W. 1, England

Sociedad de Ortodoncia de Chile

President, Alejandro Manhood - - - - - - - - - - - - - - - Avda. B. O'Higgins 878
Vice-President, Arturo Toriello - - - - - - - - - - - - - - - - Calle Londres 63
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Treasurer, Pedro Gandulfo - - - - - - - - - - - - - - - - - Calle Londres 63

Sociedad Argentina de Ortodoncia

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Secretary, Ludovico E. Kempter
Treasurer, Edmundo G. Locci

Sociedad Peruana de Ortodoncia

President, Augusto Taiman
Vice-President, Ricardo Salazar
Secretary, Carlos Elbers
Treasurer, Gerardo Calderon

Asociación Méxicana de Ortodoncia

President, Guillermo Gamboa - Madero 34-3
Secretary, Rutilio Blanco - - - - - - - - - - - - - - - - - - - Donceles 98-209
Treasurer, Carlos M. Paz - - - - - - - - - - - - - - - - - - Av. Insurgentes 72

*The Journal will publish the names of the president and secretary-treasurer of foreign orthodontic societies if the information is sent direct to the editor, 8022 Forsythe, St. Louis 5, Mo., U. S. A.